BENCHMARKED: The P6 & WINDOWS 95

affic
recasting
Begins after p. 48

BYTE

THE MAGAZINE OF TECHNOLOGY INTEGRATION

OCTOBER 1995

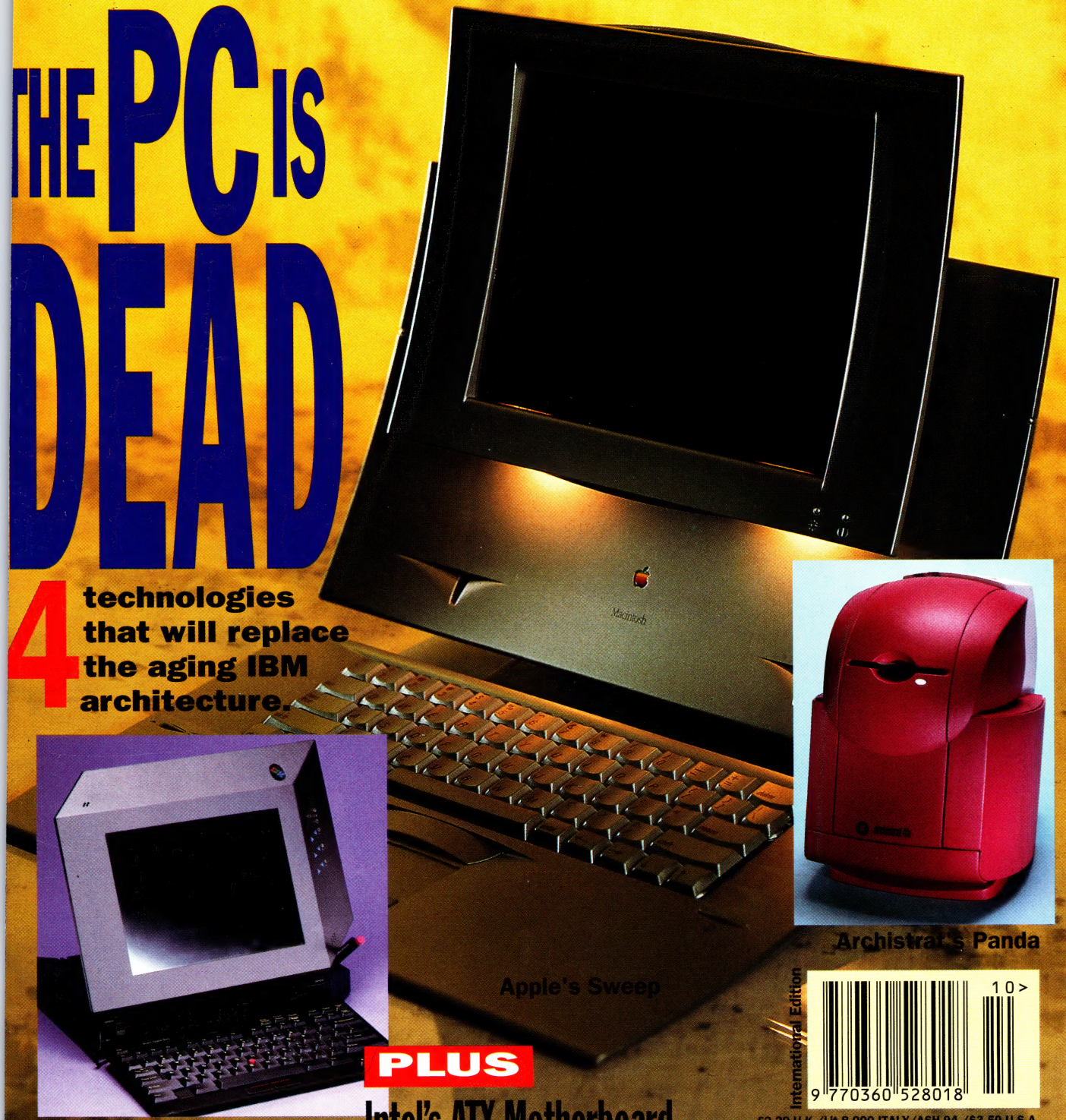
Reviewed: The Best Portables

Revealed: What Microsoft Left Out of Windows 95 P. 27

IF U CNT RD THS C R ENCRPTN STRY P. 77

THE PC IS DEAD

4 technologies that will replace the aging IBM architecture.



Archistrat's Panda

Apple's Sweep

IBM's Leapfrog

PLUS

Intel's ATX Motherboard

International Edition

10>

9 770360 528018

£2.20 U.K./Lit.8,000 ITALY/ASH 94 /$3.50 U.S.A.
A Publication of the McGraw-Hill Companies/0360-5280

P133 MILLENNIA™ PLUS

- Intel 133MHz Pentium® processor
- 256K Micron SyncBurst™ cache, Flash BIOS
- PCI 32-bit Fast SCSI-2 controller
- 6X SCSI-2 CD-ROM drive, 3.5" floppy drive
- SoundBlaster™ 16 stereo sound & speakers
- PCI 64-bit graphics accelerator (2MB)
- *Tool-Free* mini-tower or desktop
- Microsoft® Mouse, 101-key keyboard
- Choice of MS Windows® 95 CD or MS-DOS® & Windows for Workgroups CD
- Microsoft Office Professional CD

A • 16MB EDO RAM • 1GB SCSI-2 hard drive
• 15" Micron 15FGx, 1280NI, .28mm
$3,499 (Business Lease $119/month)

B • 32MB EDO RAM • 2GB SCSI-2 hard drive
• 15" Micron 15FGx, 1280NI, .28mm
$4,499 (Business Lease $153/month)

C • 64MB EDO RAM • 4GB SCSI-2 hard drive
• 17" Micron 17FGx, 1280NI, .28mm
$6,499 (Business Lease $213/month)

D* • 128MB EDO RAM • 9GB SCSI-2 hard drive
• 21" Micron 21FGx, 1600NI, .28mm
$11,499 (Business Lease $369/month)
*Option D not available in desktop

P75 POWERSTATION

- Intel 75MHz Pentium processor
- 256K write-back cache, Flash BIOS
- 4X EIDE CD-ROM drive, 3.5" floppy drive
- SoundBlaster 16 stereo sound & speakers
- PCI 64-bit graphics accelerator (2MB)
- *Tool-Free* mini-tower or desktop
- Microsoft Mouse, 101-key keyboard
- Choice of MS Windows 95 CD or MS-DOS & Windows for Workgroups CD

A • 8MB EDO RAM • 850MB EIDE hard drive
• 15" Micron 15FGx, 1028NI, .28mm
• Microsoft Works Multimedia CD
$1,899 (Business Lease $71/month)

B • 16MB EDO RAM • 1.2GB EIDE hard drive
• 15" Micron 15FGx, 1280NI, .28mm
• Microsoft Office Professional CD
$2,399 (Business Lease $85/month)

C • 32MB EDO RAM • 1.6GB EIDE hard drive
• 17" Micron 17FGx, 1280NI, .28mm
• Microsoft Office Professional CD
$3,499 (Business Lease $119/month)

- *With 90MHz Pentium processor.....add $100*
- *With 100MHz Pentium processor.....add $200*

P90 POWERSTATION

- Intel 90MHz Pentium processor
- 256K write-back cache, Flash BIOS
- 4X EIDE CD-ROM drive, 3.5" floppy drive
- SoundBlaster 16 stereo sound & speakers
- PCI 64-bit graphics accelerator (2MB)
- *Tool-Free* mini-tower or desktop
- Microsoft Mouse, 101-key keyboard
- Choice of MS Windows 95 CD or MS-DOS & Windows for Workgroups CD

- *With 100MHz Pentium processor.....add $100*

A • 8MB EDO RAM • 850MB EIDE hard drive
• 15" Micron 15FGx, 1280NI, .28mm
• Microsoft Works Multimedia CD
$1,999 (Business Lease $71/month)

B • 16MB EDO RAM • 1.2GB EIDE hard drive
• 15" Micron 15FGx, 1280NI, .28mm
• Microsoft Office Professional CD
$2,499 (Business Lease $89/month)

PC MAGAZINE EDITORS' CHOICE — May 30, 1995 — P120 MILLENNIA

PC MAGAZINE EDITORS' CHOICE — June 28, 1994 — P90PCI POWERSTATION

PC MAGAZINE EDITORS' CHOICE — May 16, 1995 — P90 HOME MPC

PC WORLD WORLD CLASS 1995 — July 1995 — P90 HOME MPC

PC WORLD BEST BUY — February 1995 — P90 HOME MPC

PC WORLD BEST BUY — October 1994 — P90PCI POWERSTATION

intel inside pentium PROCESSOR

STELLAR PERFORMANCE

Micron is fast becoming the industry leader in personal computer design, engineering and manufacturing. Right off the production line, Micron PCs are receiving awards and critical acclaim for exceptional quality, record-breaking speed and dependable performance. Everywhere you turn, Fortune 500 corporations, mid-size businesses and home offices are discovering the benefits of buying a Micron computer.

P133 POWERSERVER SMP

MICROSOFT WINDOWS NT READY-TO-RUN

- Intel 133MHz Pentium processor
- Dual Pentium SMP ZIF sockets
- 512K write-back cache, Flash BIOS
- Slots: 5 EISA, 2 PCI, 1 EISA/PCI
- PCI 32-bit Fast SCSI-2 controller
- 4X SCSI-2 CD ROM drive, 3.5" floppy drive
- PCI 64-bit graphics accelerator (2MB)
- Full-size tower with 10 drive bays
- Microsoft Mouse, 101-key keyboard
- Choice of MS Windows 95 CD or MS-DOS & Windows for Workgroups CD

A • 16MB RAM • 1GB SCSI-2 hard drive
• 15" Micron 15FGx, 1280NI, .28mm
$3,999 (Business Lease $136/month)

B • 32MB RAM • 2GB SCSI-2 hard drive
• 15" Micron 15FGx, 1280NI, .28mm
$4,999 (Business Lease $170/month)

- *With second 133MHz Pentium processor....add $999*
- *With Windows NT Workstation CD.....add $249*

P133 HOME MPC PRO

The Ultimate Home Office Performance System

P133 HOME MPC PRO

- Intel 133MHz Pentium® processor
- 256K Micron SyncBurst™ cache, Flash BIOS
- 16MB EDO RAM, 1.2GB EIDE hard drive
- 4X EIDE CD-ROM drive, 3.5" floppy drive
- SoundBlaster™ 16 stereo sound & speakers
- 14.4 Fax/Modem, speakerphone, voice mail
- PCI 64-bit graphics accelerator (2MB)
- 17" Micron 17FGx,1280NI,.28mm
- *Tool-Free* mini-tower or desktop
- Microsoft® Mouse, 101-key keyboard
- Choice of MS Windows® 95 CD or MS-DOS® & Windows for Workgroups CD
- Microsoft Office Professional CD
- Microsoft Scenes: Sports Extremes; Microsoft Bob™ CD; Microsoft Encarta™ 95 CD; Quicken™ Deluxe Edition CD; Microsoft Dangerous Creatures CD; Microsoft Golf Multimedia CD; Trial Subscriptions for CompuServe™, America OnLine™ & Prodigy™.

$3,499

PC MAGAZINE EDITORS' CHOICE

May 16, 1995
P90 HOME MPC

PC WORLD WORLD CLASS 1995

July 1995
P90 HOME MPC

intel inside pentium PROCESSOR

P75 HOME MPC

- Intel 75MHz Pentium processor
- 256K write-back cache, Flash BIOS
- 8MB EDO RAM, 850MB EIDE hard drive
- 4X EIDE CD-ROM drive, 3.5" floppy drive
- SoundBlaster 16 stereo sound & speakers
- 14.4 Fax/Modem, speakerphone, voice mail
- PCI 64-bit graphics accelerator (2MB)
- 15" Micron 15FGx,1280NI,.28mm
- *Tool-Free* mini-tower or desktop
- Microsoft Mouse, 101-key keyboard
- Choice of Windows 95 CD or MS-DOS & Windows for Workgroups CD
- Microsoft Works Multimedia CD
- Microsoft Scenes: Sports Extremes; Microsoft Bob CD; Microsoft Encarta 95 CD; Quicken Deluxe Edition CD; Microsoft Dangerous Creatures CD; Microsoft Golf Multimedia CD; Trial Subscriptions for CompuServe, America OnLine & Prodigy.

$1,999

- With 90MHz Pentium processor.....add $100
- With 100MHz Pentium processor.....add $200

Micron Electronics, Inc., 900 E. Karcher Road, Nampa, ID 83687 • Mon-Fri 7AM-8PM Sat 8AM-5PM (MT)
208-463-3434 • FAX 208-463-3424 • Purchase Order FAX 208-467-5384

It's Your Call!

800-233-7027

MICRON ELECTRONICS, INC.

International Sales 208-465-8970 | International FAX 208-465-8993 | From Mexico Call 95-800-708-1755 | From Puerto Rico Call 800-708-1756 | From Canada Call 800-708-1758

© 1995 Micron Electronics, Inc. All rights reserved. All prices and specifications subject to change without notice. Micron Electronics, Inc. cannot be responsible for omissions and/or errors in typography or photography. "Mark Your Place With The Leader" is a service mark of Micron Electronics, Inc.. Intel, Intel Inside, and Pentium are registered trademarks of the Intel Corporation. Microsoft is a registered trademark and Windows, Windows NT and the Windows logos are trademarks of Microsoft Corporation. All other company trademarks are trade names of each respective company. Prices do not include shipping and handling. 30-day risk-free money back guarantee does not include return freight and original shipping/handling charges, applies only to Micron brand products, and begins from date of shipment. All returns require RMA numbers and must be shipped in the original condition prepaid and insured. Lease prices based on 36-month lease.

THE FUTURE OF WINDOWS

MICRON
ELECTRONICS, INC.

THE MICRON MILLENNIA™

"Buyers looking for the fastest system money can buy will find it in the Micron Millennia."
PC Week, May, 1995

And the reason for the Micron P120 Millennia's amazing ability to far outperform the competition? It's exclusive dynamic combination of Micron's EDO (Extended Data Out) Memory and SyncBurst™ cache, providing significant performance gains over previous memory designs. Once again, another major breakthrough in computing performance innovation from Micron, the technology leader.

P120 MILLENNIA

- Intel 120MHz Pentium® processor
- 256K Micron SyncBurst™ cache, Flash BIOS
- 4X EIDE CD-ROM drive, 3.5" floppy drive
- SoundBlaster™ 16 stereo sound & speakers
- PCI 64-bit graphics accelerator (2MB)
- *Tool-free* mini-tower or desktop
- Microsoft® Mouse, 101-key keyboard
- Choice of MS Windows® 95 CD or MS-DOS® & Windows for Workgroups CD

A • 8MB EDO RAM, 850MB EIDE hard drive
• 15" Micron 15FGx, 1280NI, .28mm
• Microsoft Works Multimedia CD
$2,499 (Business Lease $89/month)

B • 16MB EDO RAM, 1.2GB EIDE hard drive
• 15" Micron 15FGx, 1280NI, .28mm
• Microsoft Office Professional CD
$2,999 (Business Lease $107/month)

C • 32MB EDO RAM, 1.6GB EIDE hard drive
• 17" Micron 17FGx, 1280NI, .28mm
• Microsoft Office Professional CD
$4,099 (Business Lease $140/month)

• P133 MILLENNIA.....add $100

"The Millennia is nothing short of the best all-around PC available on the Market today."
PC Magazine, April 25, 1995

PC MAGAZINE EDITORS' CHOICE
May 30, 1995
P120 MILLENNIA

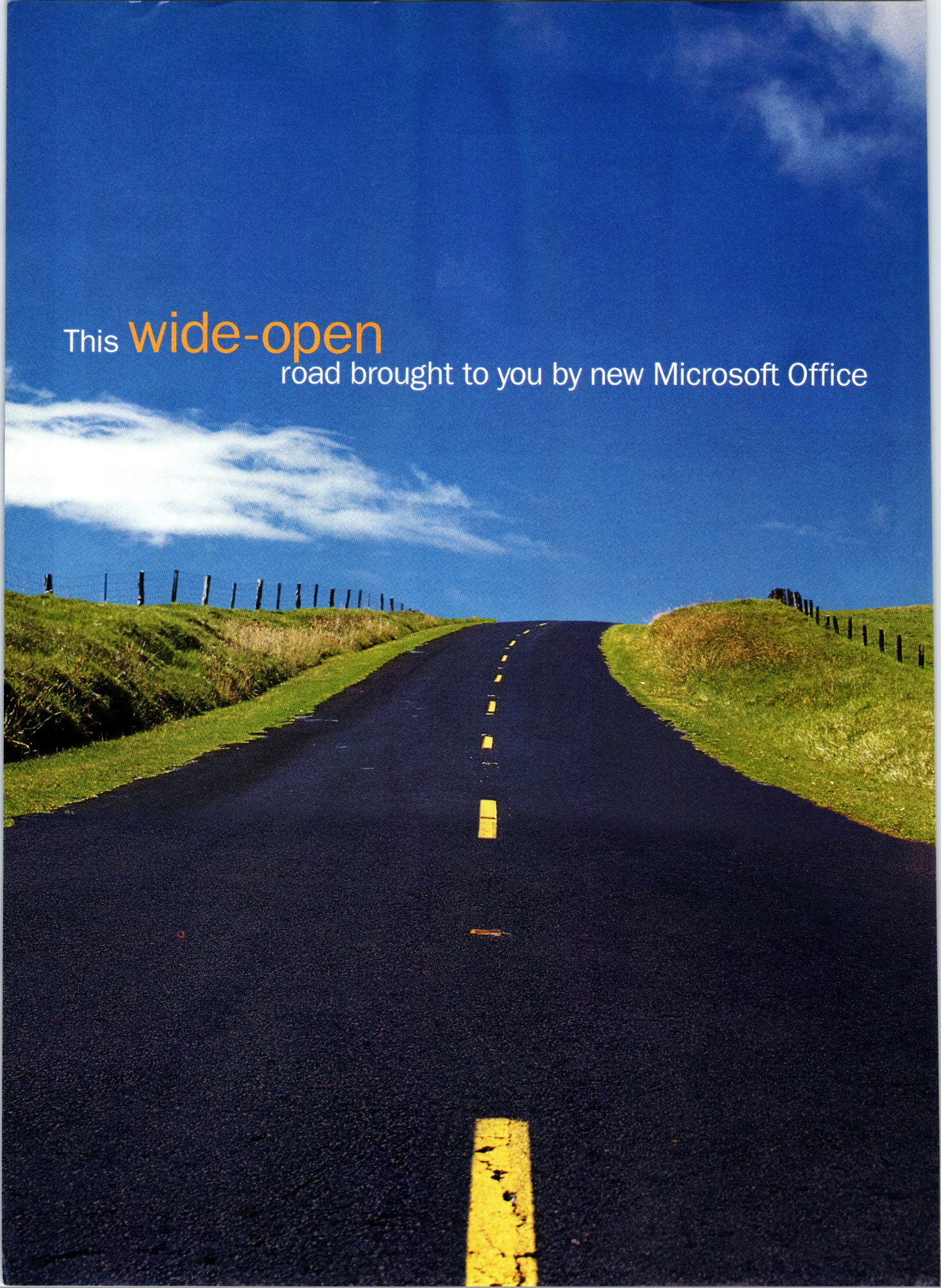
According to PC Magazine's most recent Windows based tests, the Micron P120 Millennia is a "star performer." The Millennia garnered the highest Graphics WinMark score ever seen, in addition to a top-notch Winstone score.

intel inside pentium

MICRON ELECTRONICS, INC.

800-233-7027

Circle 114 on Inquiry Card.


This wide-open
road brought to you by new Microsoft Office

Now fewer things will get between you and the way you want to work.
Start

Introducing new Microsoft Office
for Windows 95

Software that reveals itself, removes the barriers between you and capabilities old and new. Software that doesn't get in your way when you're trying to work.

Features that can streamline the way you work now reveal themselves as you work. Everyday tasks as basic as entering text are easier. Spell-checking and formatting happen automatically, on the fly. Applications that you once used in a limited fashion now offer you new and easier ways to use them, to do more with them. One of those ways is the Answer Wizard. When you have a question you simply type it in. "How do I get this page to print sideways?" It will show you how. Other wizards are built into individual programs to walk you through complex tasks. To create a customer database from scratch, you simply ask the Database Wizard to show you how. This is called IntelliSense™ technology, and it senses what you are doing, and helps you do it with fewer steps. It lets you focus on your work, not on making your software work.

Now applications work together, work alike, work the way you always hoped they would.

New Microsoft® Excel, Word, PowerPoint®, Microsoft Access, and Schedule+. Use them to work more effectively, to access and share information throughout your company, to conduct more in-depth analysis. Pull information from one application into another seamlessly. Manage your key contacts in Schedule+ and drop addresses into Word when you write them letters. Use PowerPoint's Meeting Minder to take notes of your meeting, and then export them to Word to summarize. Use the new Office Binder to create a single document that uses components from all five programs. Combine a cover letter, financial projections, and professional-looking charts and graphs seamlessly into one document. Save and print it as one. Open it and have all the applications it uses launch at once. You spend less time going back and forth between programs. Less time working around obstacles. More time focusing on the task at hand.

Microsoft®

WHERE DO YOU WANT TO GO TODAY?™

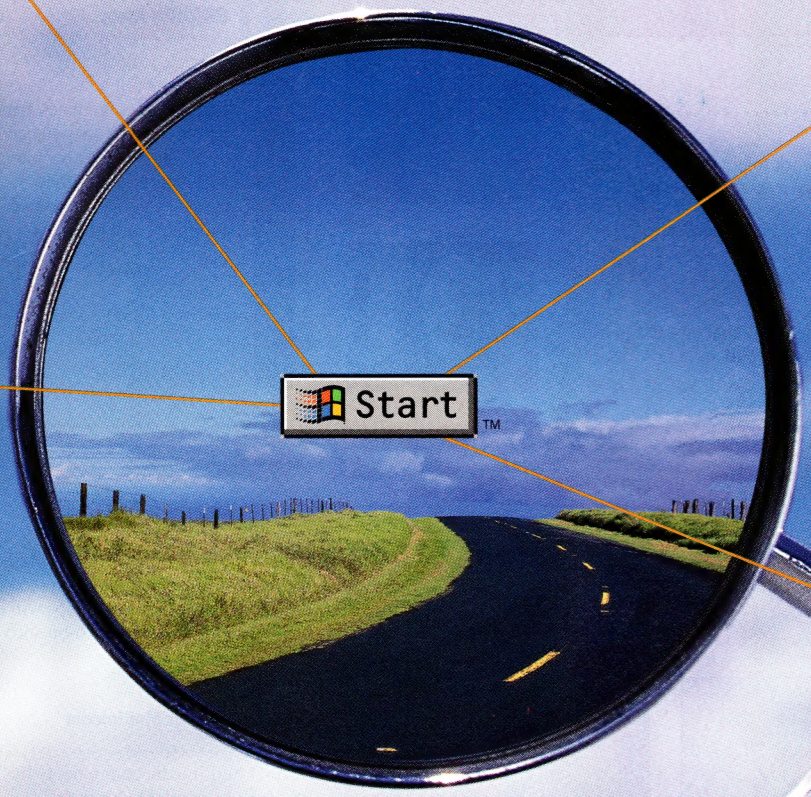
Designed for Microsoft Windows 95

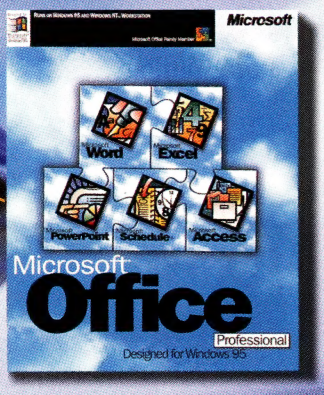
To see an autodemo and more, go to http://www.microsoft.com/msoffice. Or call 800-426-9400.

©1995 Microsoft Corporation. All rights reserved. Microsoft, PowerPoint, Windows, and the Windows logo are registered trademarks and IntelliSense, the Windows Start logo and *Where Do You Want To Go Today?* are trademarks of Microsoft Corporation. *This add-on is available at no charge (does not include shipping and handling).

Together, the programs break down the barriers between you and other people. You find new ways to communicate, to share information, to collaborate.

Now you can use Microsoft Word as your e-mail editor with the Microsoft Exchange Inbox in Windows 95. Create your messages in Word, and use all of its functionality, its formatting options, to communicate more clearly, more convincingly. With Word's Internet Assistant,* you can browse the World Wide Web and publish your own documents there. If you subscribe to The Microsoft Network, you can access it directly from Office. FindFast lets you search company servers and individual desktops for information you need by typing a phrase or key word. Even finding the information you need to schedule a meeting is made simpler with the Meeting Wizard in Schedule+. It can find a time when your list of people can meet, locate a conference room, and notify everyone of the time and place.



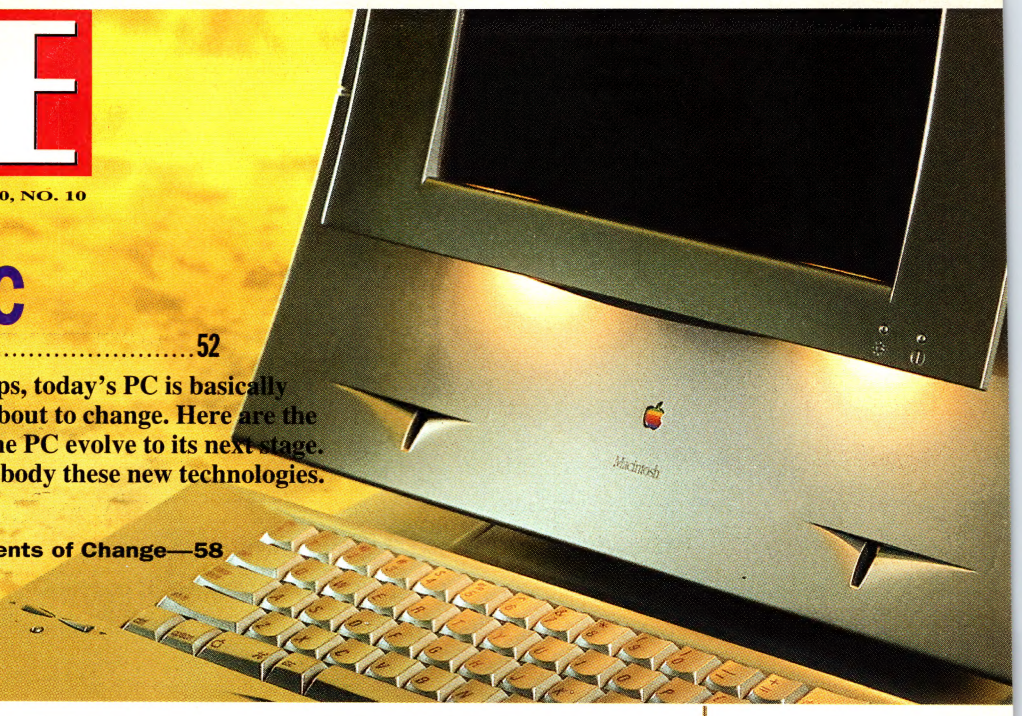


Now you can take full advantage of Windows 95.

New Microsoft Office was designed to work hand-in-hand with the Windows® 95 operating system and its simplified user interface. To make the most of 32-bit performance, long filenames, shortcuts, multitasking, and the Windows Explorer. Together, they make computing fundamentally easier and faster. They make it possible for you to spend less time computing, more time working effectively.

BYTE

OCTOBER 1995 VOL. 20, NO. 10



COVER STORY

The New PC

BY TOM R. HALFHILL 52

Despite faster and faster chips, today's PC is basically yesterday's AT. But that's about to change. Here are the technologies that will help the PC evolve to its next stage. Plus, some products that embody these new technologies.

ATX Motherboards—54
Intel and Microsoft: The Agents of Change—58
Archistrat 4s—60
120-MB Disks—62
Integrated Telephony—64

Features

VIDEOCONFERENCING

Face to Face 69
BY ANDREW W. DAVIS
Videoconferencing systems from different vendors can now work together, thanks to the H.32x standard. Plus, some products that let you send your face over the phone line.

SECURITY

Picking the Crypto Locks 77
BY PETER WAYNER
With today's hardware and a new technique called differential cryptanalysis, it's getting easier for data burglars to crack your safe. What can you do to keep them out?

Factoring in Public-Key's Future—78

THE BYTE NETWORK PROJECT

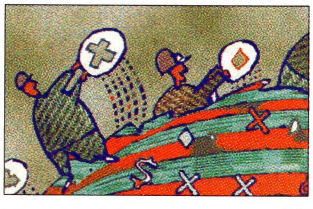
BOMB's Away 105
BY JON UDELL
How we built a Web-based survey to get feedback from readers. And how you can turn your Web server into an application server that connects you to customers, suppliers, and business partners.

Anatomy of the Web BOMB—106

State of the Art

DATA MINING

Data Mining 81
BY EDMUND X. DEJESUS
There's gold in those hills of data.



The Data Gold Rush 83
BY SARA REESE HEDBERG
Here's how corporations, researchers, and scientists are using data-mining techniques to discover everything from new customers to new galaxies.

A Data Miner's Tools 91
BY KAREN WATTERSON
You can dig it with query-and-reporting programs, multidimensional analysis software, and intelligent agents.

Data-Mining Dynamite 97
BY CHERYL D. KRIVDA
Supercharge your data-mining projects with data cleansing, data warehouses, parallel processing, and mega-storage.

Data-Warehouse Construction Tips—102

News & Views

X86 PROCESSORS

Intel's Rivals Ready to Exploit P6 Weakness 26
Intel's rivals say their next chips will be better than the P6 running 16-bit software.

WINDOWS 95

Coming: A Better Multimedia Platform 27
Several multimedia components for Win 95 won't be available for months.

DATABASE TRENDS

New Replication Options in Access, Oracle, and Notes 30
Access for Windows 95 acquires a compelling feature.

WINDOWS PROGRAMMING

Run-Time Error Checking Comes to Compilers 34
Borland, Microsoft, and Nu-Mega are

Reviews

OPERATING SYSTEMS

Windows 95: The Numbers 113
BY STANFORD DIEHL
The new Windows architecture delivers enhanced performance, but as BYTE testing reveals, there are strings attached.

WINDOWS 95

Applications 95 Arrive 117
BY STANFORD DIEHL
Programs that make Windows 95 worth the wait.

SYSTEMS

Power Mac Gets PCI 123
BY TOM THOMPSON
Apple's Power Mac 9500 delivers great performance and the promise of fast, low-cost PCI peripherals.

WORD PROCESSORS

Au Revoir, Mon Ami 127
BY KENNETH M. SHELDON
Ami Pro gets a major upgrade, new workgroup features, and a new name, Word Pro.

GRAPHICS HARDWARE

Digital Cameras for Real Work 129
BY ALAN MORGAN AND SCOTT WALLACE
New digital cameras from Apple, Kodak, and Logitech find a balance between price and image quality.

EMBEDDED DESIGN

Let's Get Small 133
BY RICK GREHAN
A remarkably complete embedded development system.

FAX PROGRAMS

Software Roundup: Industrial-Strength Fax Servers 137
BY REX BALDAZO, DAVID ESSEX, AND STAN MIASTKOWSKI
After some hair-pulling, teeth-gnashing installations, we test network-based faxing software that can handle the heavy loads of a workgroup.

Core Technologies

CPUS

Is There a GLINT in Your Future? 167
BY TREVOR MARSHALL AND JOHN DAVEY
3Dlabs' chip produces fast 3-D graphics. Here's how it does those dazzling displays.

OPERATING SYSTEMS

Weaving a Thread 173
BY SHASHI PRASAD
Solaris and Windows NT bring the power, speed, and efficiency of multithreading and symmetric multiprocessing to the desktop.

PROGRAMMING

The Standard Template Library 177
BY ALEXANDER STEPANOV
How do you build an algorithm that is both generic and efficient?

NETWORKS

Internet Firewalls 179
BY STEPHEN COBB
An industry group is attempting to bring order to firewalls, demand for which is spurred by intrusions.

NOTEBOOK COMPUTERS

Lab Report: 11 Ultraportables Go the Distance 146
BY ANTHONY J. LENNON AND JOHN MCDONOUGH

These lightweight, feature-packed tiny PCs hold some surprises and won't cramp your style.

High-End Ultraportables—148
Lower-Cost Alternatives—150
How We Tested—156
Hot CPU Chips Keep Their Cool—156
Apple's Dynamic Duo—160
Color for the Road—160
Honorable Mentions—161
Zinc-Air Batteries Last All Day—161

building real-time error checking into their compilers.

WINDOWS 95

We Plugged, but They Didn't All Play 36
Tests of several new Plug and Play devices show that unless you have all the required pieces in your system, you can expect to do a lot of work.

INTERNET BROADCASTING

Radio Comes to Cyberspace 46
A new era in broadcasting begins on the Internet.

FUTURE DISPLAY TECHNOLOGIES

3-D Images That Float in Air 48
A new system can project images from a PC so that they appear to be solid objects suspended in air.

NEW PRODUCTS

What's New 190
Apple's PowerBook 5300c combines RISC processing power with great battery life; Intuit's QuickBooks Pro manages your business finances; plus more.

Opinions

Pournelle: Death Swoops and Upgrades 181
BY JERRY POURNELLE
Jerry witnesses several test flights: First the DC/X spacecraft, and then a new Pentium, a new hard drive, and several builds of Windows 95.

Books & CD-ROMs: Working in the Code Mine 49
BY DENNIS BARKER AND JEFF MACCLAY
A novel about working at Microsoft. Plus, a Marilyn Monroe CD-ROM.

Commentary: Ambiguity Machines 250
BY JACQUES LESLIE
Computers are better at poetry than mathematics.

Editorial 12
BY RAPHAEL NEEDLEMAN

Letters 20
Readers write about our coverage of Windows 95, Microsoft, OS/2, and RAD; an Amiga update; and more.

International Section 48IS1

Reader Survey 199

READER SERVICE

Editorial Index by Company 248
Alphabetical Index to Advertisers ... 244

Index to Advertisers by

Product Category 246
Inquiry Reply Cards 96A, 244A

BUYER'S GUIDE 201
Mail Order
Hardware/Software Showcase
Buyer's Mart

PROGRAM LISTINGS

FTP: ftp to ftp.byte.com

From BIX: Join "listings/frombyte95" and select the appropriate subarea (i.e., "oct95."

From the BYTE BBS at 1200-9600 bps: Dial (603) 924-9820 and follow the instructions at the prompt.

COVER IMAGE: GREG MILLER AND ED JUDICE © 1995

BYTE Contents by Platform

This page presents the articles in this issue according to computing platform.

DOS/WINDOWS

Intel's Rivals Ready to Exploit P6 Weakness.....26
Further tests confirm what we reported last month: If you're running mainly 16-bit DOS and Windows applications, don't rush out to buy a P6 PC. Or maybe you should consider AMD's K5 or Cyrix's M1.

Coming: A Better Multimedia Platform.....27
Windows 95 has several technology components, such as 32-bit video codecs, designed to make it a better foundation for multimedia. But some other significant pieces are missing.

New Replication Options in Access, Oracle, and Notes.....30
Database programs get a feature that will be a big hit among developers supporting remote workers.

Run-Time Error Checking Comes to Compilers.....34
New development packages from Borland, Microsoft, and Nu-Mega should help Windows programmers check their code.

We Plugged, but They Didn't All Play.....36
We test a bunch of alleged Plug and Play devices and find that you often have to do some work before you get to play. Somehow it's not surprising.

Face to Face.....69
This explanation of the H.32x standard also looks at some Windows products for videoconferencing.

A Data Miner's Tools.....91
Forget the pick and shovel. Here are programs that can help you sift through mountains of data and separate the nuggets from the slag.

Windows 95: The Numbers....113
BYTE tests shipping Windows 95 code against Windows for Workgroups 3.11, revealing the performance limitations of Microsoft's new OS.

Applications 95 Arrive.....117
Enterprises might not rush to deploy a new desktop interface, but they will move to Windows 95 for the powerful new applications it enables. Here's a review of some of the best so far.

Au Revoir, Mon Ami.....127
Lotus's new version of Ami Pro—now called Word Pro—has some innovative additions, especially for workgroups.

Digital Cameras for Real Work.....129
Affordable digital cameras—priced under $1000—from Apple, Kodak, and Logitech are good for business, scientific, and publishing applications.

Weaving a Thread.....173
Borrowing from the ideas of object-oriented programming, Windows NT was designed from the ground up to support multiprocessing and multithreading.

Pournelle: Death Swoops and Upgrades.....181
In a month of big upgrades, Dr. Pournelle installs the latest version of Win 95 and—guess what?—runs into a few problems.

OS/2

Whatever Happened to . . . ?...34
In which we report on the whereabouts of OS/2 for the PowerPC.

Code Talk: A New Age for OS/2 Programmers.....46
Rick Grehan works with the latest version of IBM's Visual Age C++ development environment for OS/2. It combines visual programming tools with a compiler,

Pournelle: Death Swoops and Upgrades.....181
It's upgrade time at Chaos Manor. Jerry installs OS/2 Warp Connect. Despite "one major design defect," he finds it "solid as a rock."

MACINTOSH

Options Increase, Prices Drop for Mac Add-Ons.....40
If you've got a PCI Macintosh, you're going to have a big selection of graphics accelerators. Card kings of the PC realm (ATI, Matrox, miro, and others) are bringing their products to the new-bus Macs.

Face to Face.....69
Videoconferencing gets a compatibility kick from the H.32x standard. QuickTime Videoconferencing and other products bring H.32x support to the Mac.

A Data Miner's Tools.....91
Specialized software for digging valuable information out of mountains of stuff.

Power Mac Gets PCI.....123
If you were getting delirious and thinking you needed a Pentium, stop right now and read this review. The PCI-based Power Mac 9500 is the new Apple dream machine.

Digital Cameras for Real Work.....129
Apple's QuickTake 150 digital camera offers improved resolution and image processing. Similar cameras from Kodak and Logitech provide higher resolution for printed images and have Mac software, too.

Apple's Dynamic Duo.....160
The PowerBook Duo 2300, with its PowerPC 603 CPU, provides RISC performance and long battery life. It's a welcome addition to anyone's briefcase.

UNIX

Weaving a Thread.....173
The two-tier thread library in Sun's Solaris lets applications developers take advantage of multiprocessing and multithreading.

NETWORKS

New Replication Options in Access, Oracle, and Notes.....30
Databases make it easier for mobile and remote workers to be in sync with the home office.

We Plugged, but They Didn't All Play.....36
We test some allegedly Plug and Play products—including some network cards—with Windows 95.

The New PC.....52
Personal computers of the next two to five years will be better equipped for networking, with connectivity built into the hardware and the OS.

Face to Face.....69
Getting one videoconferencing system to work with another is going to be less of a sticky wicket, thanks to an international standard called H.32x.

Data-Mining Dynamite.....97
One of the best ways to capitalize on an enterprise's information is to build a data warehouse, a server-based replication of a mainframe's data. When users need information, they send a query to the warehouse.

BOMB's Away.....105
Web technology isn't just a way to publish electronic documents. It's also a way to build networked applications that work within and beyond corporate boundaries.

Applications 95 Arrive.....117
Visual Voice for Win32 is one of the killer applications for Windows 95. This 32-bit OLE implementation provides developers with tools to build telephony-based applications.

Internet Firewalls.....179
Internet connections are being hacked and cracked at an alarming rate. Firewall technology can keep your network safe. A new consortium aims to ensure the reliability of these network condoms.

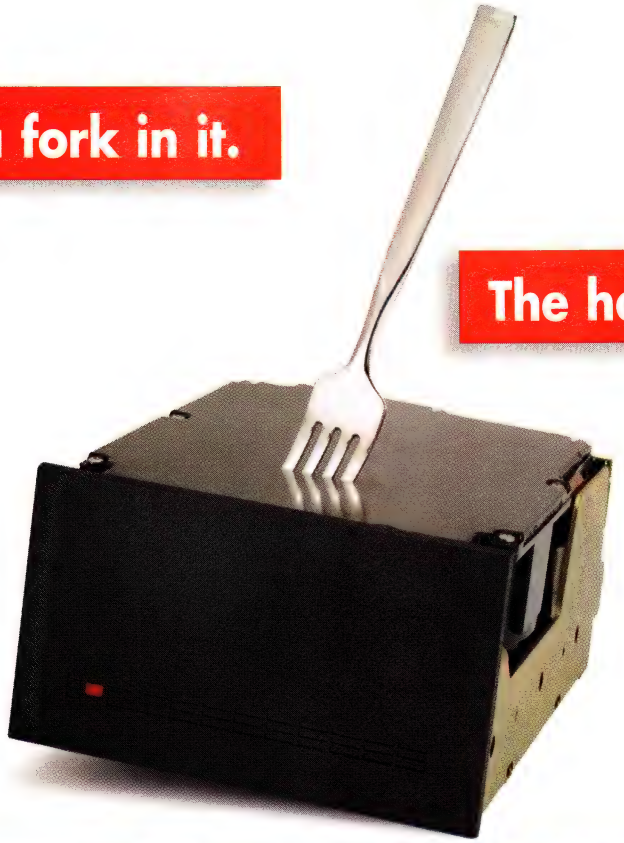
Pournelle: Death Swoops and Upgrades.....181
Jerry checks out SnapBack, a backup program he thinks Novell system administrators will love.

Index

Algorithms.....177
Audio.....46
Battery technology.....161
C++.....34, 46, 177
CD-ROM.....49
Common Gateway Interface...105
Componentware.....117
CPUs.....26, 52, 156, 181, 184
Databases.....30, 91, 97
Data mining....81, 83, 91, 97
Digital cameras.....129
Display technology.48, 52, 167
Fax servers.....137
Graphics....40, 48, 117, 167
HTML.....105
Internet.....46, 48, 105, 179
ISDN.....69
Macintosh.....40, 123, 129, 160, 190
Memory architecture.....52
Multimedia.....27, 181
Multiprocessing.....97, 173
Networks.....105, 106, 137, 179
Notebooks.....146, 190
OLE.....117
Operating systems..27, 34, 36, 113, 117, 173, 181
OS/2.....34, 46, 181
PCI.....40, 123
P6.....26
Plug and Play.....36, 52
PowerPC.....123
Printers.....154
Programming.....34, 46, 106, 133, 177
Security.....77, 179
Storage.....52, 181
System architecture.....52
Telephony.....52, 69
3-D.....48, 167
Universal serial bus.....52
Videoconferencing.....69
Windows.20, 26, 30, 34, 36, 113, 117, 127, 137, 181
World Wide Web.....105

Put a fork in it.

The hard drive is done.



Optical's Cookin'

INTRODUCING THE PINNACLE APEX 4.6 GB™ OPTICAL HARD DRIVE

THE BIGGEST BREAKTHROUGH IN STORAGE

The only two advantages magnetic hard drives held over optical drives have now been eliminated. In both price and performance, the new Pinnacle Apex 4.6 GB is the first optical drive to totally cook magnetic hard drives.

- **Faster than average hard drive (throughput 6 MB/sec max)**
- **Less expensive than hard drives of equal size**
- **Enormous 4.6 Gigabyte capacity per disk**
- **Unlimited capacity - just add another disk**
- **Direct Overwrite media (one-pass write)**
- **Greater reliability and durability than hard drives**
- **Removable disks allow easy portability and security**

THE CROSSOVER IN STORAGE TECHNOLOGY

We've always known that some day optical drives would replace magnetic hard drive technology in the computer industry. Simply put: optics are superior to magnetics. The numerous limitations of hard drives make this fact obvious. Hard drives crash, they're a pain to move around, they fill up too quickly, and you constantly have to back them up.... So why do we buy these things? Because up until now, we've never had an alternative that offered the speed, price and capacity of the Pinnacle Apex 4.6 GB optical drive. The Apex signals the dawn of a new era in computer storage.

Internal PC version • 5.25" half-height

DESIGNED FOR ALL YOUR STORAGE NEEDS

The Apex's combination of high capacity, impressive speed and removable/portable media make it the ideal storage device for a broad range of applications:

- **General Data Storage • Graphics/Desktop Publishing**
- **Digital Video • Digital Audio • Data Archiving**

No matter what your application, the Apex's recipe of price-performance, removability, and reliability make it the obvious choice over magnetic hard drives. With its removable disks, it's the last storage system you'll ever need to buy - the revolutionary Pinnacle Apex 4.6 GB optical hard drive. Now that we've whetted your appetite, satisfy your hunger for storage with the hottest drive ever.

APEX 4.6 GB™ OPTICAL HARD DRIVE
$1695
INCLUDES 1 PIECE OF MEDIA

5.25" 4.6 GB REWRITABLE OPTICAL MEDIA
$199

"Barbecue Bill" Blum
President & CEO

To order or for a dealer near you call:
1-800-553-7070

PINNACLE MICRO
THE OPTICAL STORAGE COMPANY™

Tel: 714-789-3000 Fax: 714-789-3150
CompuServe: 70534,3026

Circle 87 on Inquiry Card (RESELLERS: 88).

Olivetti Modulo

Before choosing any other PC, count to ten.

1 Price and performance.

Making investments without running risks is a vital necessity for today's companies. This is why those intending to make the smart choice turn to Olivetti Modulo PCs. Conceived where technological know-how meets market requirements, the Modulo series is the PC line which represents the best solution from all standpoints for users wanting to maximize the cost/performance relationship. A secure long-term investment guaranteed by Olivetti quality.

2 Pentium® processor power.

The Modulo M4-90 and M4-75 models are equipped with the new Intel Pentium® microprocessor: enormous power - in its most available form - to make the most out of the applications and environments of the new generation.

3 Pentium® processor upgradability.

Users choosing the Modulo PCs know that they can count on an expandable and upgradable product based on their specific needs. All models can be equipped with the OverDrive or Pentium® OverDrive, the ultra-high performance processor based on Pentium® Upgrade.

4 The best of available technologies.

The Modulo M4-75 and M4-90 deliver a broad range of technology innovation: the PCI local bus, that allows peripherals to operate at maximum speed, the Plug & Play

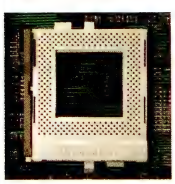
rchitecture, that automatically
nfigures your expansion card
ithout the need for experts,
high-speed 64-bit graphics
celerator on motherboard and
ne Fast IDE interface for fast access
storage peripherals.
addition, for selected models
ne LAN Ethernet on motherboard
llows immediate integration
ith your network.
Modulo PCs can also be equipped
s full multimedia systems.
With Modulo PCs, technological
volution becomes accessible to
veryone, allowing each user to increase
ndividual and group productivity.

5 Certified with over 300 SW/HW products.

All Modulo PCs are sold with MS-DOS and Windows for Workgroups and are ready to implement Windows 95 as standard equipment. In addition, the hardware and software are fully compatible with all present market standards, tested with over 300 applications and certified by the world's major software producers.

6 Millions of test hours.

CE, IMQ, NEMKO, CSA, FCC, UL, Energy Star are the international marks which, along with millions of test hours per year, guarantee the absolute quality of Olivetti PCs.
Total reliability, therefore, with complete adherence to the most exacting international standards: the very best for companies that expect the best.



With the OverDrive socket, Modulo is ready to integrate Pentium® technology.

MODULO	M4-90	M4-75	M4-584	M4-564
Microprocessor	Pentium® 90	Pentium® 75	DX4	DX2 66
Pentium upgradability	ZIF#5	ZIF#5	ZIF#3	ZIF#3
HW architecture	PCI	PCI	ISA/PCI	ISA/PCI
"Green" features	Yes	Yes	Yes	Yes
Plug & Play	Yes	Yes	Yes	Yes
RAM (MB) /Cache (KB)	8/256	8/256	8/256	8/256

7 Environmental care.

Respect for the environment has always been a priority in Olivetti's choices.
For this reason, Modulo - like all Olivetti PCs - is produced with 77% recyclable materials. But ecology also means energy saving: in accordance with Energy Star mark the Power Management System permits considerable energy savings when the PC is switched on but unattended.

8 Three-level security.

When it comes to security and data secrecy, Modulo PCs are second to none. With numerous options on three levels (hardware, software and mechanical), all data and applications - of prime importance to a company's life today- can be accessed only by authorized persons.

Three security levels : hardware, software and mechanical. This is how Modulo PCs store data in maximum security and secrecy.

9 ISO 9241 and CE : full conformity.

Olivetti has maximum respect for the requirements and safety of users. A tangible example of Olivetti's full conformity with the European ISO 9241 standards is in the monitors with their high image-stability and low radiation emissions.
Or in the casing and the keyboards, designed according to the most advanced ergonomic criteria.
In addition, the CE brand guarantees the absolute conformity of Olivetti PCs to the European safety and EMI (Electro Magnetic Interference) compatibility standards.

ISO 9241

CE

10 Customer care: 15,000 specialists.

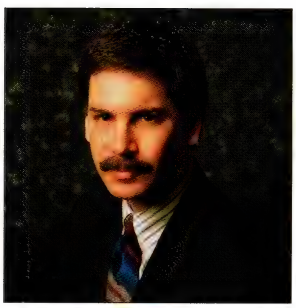
Choosing Modulo, or any other Olivetti PC, means choosing an international network of 5,500 Dealers and System Partners and 15,000 specialists to provide companies with all the assistance, support and advice they need.
Just one more reason, besides the above, for relying on Olivetti.
And for counting to ten before choosing any other PC.

For further information, phone :
Austria (1) 86694 - 0 - Belgium (2) 2299111
Denmark (31) 70203070 - Finland (0) 88741
France (1) 49067111
Germany (69) 66922755
Greece (1) 9373800 - Holland (71) 319931
Israel (3) 7516879 - Italy (167) 012587
Norway 2218 6100 - Portugal (1) 3558260
Spain (900) 370370 - Sweden (8) 59005200
Switzerland (1) 8391565
Turkey (212) 2750810 - U.K. (800) 447799.

olivetti

® The Intel Inside logo, Pentium processor, is registered TMs of Intel Corporation. All brands and trademarks are the property of respective owners.

I Can See What You Mean



New products and services will free us from the shackles of old technology. First to fall: the PC's AT architecture.

From the home office I've set up in my Boston apartment, I have a clear view across the Charles River to MIT. Sometimes when I'm editing a BYTE story about far-future technology, I look up from my desk and wonder just what is going on in the MIT Media Lab, what strange future they're assembling over there.

But it turns out that with the right software, I can see what they're doing. Literally. MIT, along with dozens of other institutions and businesses, runs a number of Web-accessible spy cameras (or just *cams* in the vernacular). There's even a guy over there, Steve Mann, who has mounted a wireless video camera on a helmet. Jump to his page (http://www white.media.mit.edu/~steve/netcam.html) and you can see what he sees.

Mann, in fact, has a troop of friends with headcams. You think the scariest moment in a businessperson's life is when Dan Rather and the *60 Minutes* crew knocks on the door? Try to imagine how you'd feel if six people wearing head-mounted video cameras showed up in your office.

Among the mad-scientist community of computer engineers, it's an accepted notion that wearable computers and their I/O devices are just around the bend. And it's also accepted that, not far behind them, is the generation of users who will come to accept implanted computer technology.

As Marc Demarest, director of strategic marketing for Sequent Computer Systems, says, "The computer wants inside your head." He expounds the frightening point of view that technological evolution is opportunistic, like the evolution of parasites. The devices seek hosts. And he doesn't mean Sequent superminicomputers. He means a living, breathing class of host, who will come to depend on technology the way we now depend on the bacteria in our digestive system.

His evidence: Computers are getting closer to us and our personalities. We can now get affordable virtual-reality goggles that put SVGA monitors 2 inches from our eyeballs. And there is a whole industry growing up around designer mouse pads, screen borders, and even color-coordinated computers—all of which are designed to make us more comfortable with the technology. But technology would be even more "in our head," Demarest says, if software user interfaces were less adversarial and more visceral, as they are in good video games, which present enormous amounts of information—graphical, intuitively—and put the player in a "tight loop" of information and response.

If the concept of computer evolution matching biological evolution is a little too far out for you to grapple with right now, at least you can agree with me that the computer wants inside your wallet. When we began doing this month's Cover Story, "The New PC," I called Ted Selker, IBM's manager of its user systems ergonomics research division. Selker designed the IBM TrackPoint eraserhead pointing device, not to mention the Butterfly keyboard on the ThinkPad 501C. I asked him what leading-edge machines he had floating around in his lab that he could send us for the story. He said, "Give me two days. I'll build you a wallet computer."

The wallet computer didn't make it into this issue (too far out even for us), but several other new technologies did, including those embodied in the machines on this month's cover. Illustrating the latest trends in dockable portables is IBM's Leapfrog (the squarish machine with the confusing case). Apple shows its vision of portable technology migrated to the desktop (check out the screen and keyboard), and Archistrat has a line of computers based on a new bus architecture.

None of these machines use the ancient architectures of the PC—ISA cards and slow serial ports, for example. We think that's great. The old architecture has been with us for too long and is hobbling our steps into the future. These new machines are the platforms for the future. We'll be seeing new architectures on our desks soon, just as you may soon be seeing wearable webcams in your office lobby. ■

RAPHAEL NEEDLEMAN, EDITOR IN CHIEF
(rafe@well.com)

TCP/IP CONNECTIVITY, AS DESIGNED BY NETWORK PROFESSIONALS.

Now, Windows users move freely wherever they need to go with the Reflection Network Series® version 5.0 from WRQ.

This is TCP/IP connectivity created with your needs in mind, from providing smooth access to corporate computers to touring global information networks. This enhanced new version offers all the transport protocols, powerful applications, and an exceptionally reliable TCP/IP stack.

It even includes management and diagnostic tools that put you in control, and specialized features for mobile/wireless computing.

REFLECTION NETWORK SERIES®

- ***PROTOCOLS:*** TCP/IP, UDP/IP, NS/VT, LAT, IPX/SPX, NETBIOS, SLIP/CSLIP
- ***APPLICATIONS:*** NFS WITH OLE SUPPORT, FTP, TFTP, LPR/LPD, FINGER, PING, INTERNET APPLICATIONS
- ***NETWORK MANAGEMENT TOOLS:*** SNMP MIB II, PRIVATE MIB, EVENT LOG/VIEWER, TRACE ROUTE, DHCP, BOOTP, RARP
- COOPERATIVE VxD/DLL DESIGN WITH 100% WINDOWS SOCKETS COMPATIBILITY

WRQ OFFERS REFLECTION PC-TO-HOST CONNECTIVITY FOR UNIX, X, DIGITAL, HP, AND IBM SYSTEMS

Call today and try it. Your network performance could rise to a whole new level.

Reflection TCP/IP

Argentia—TCW Argentina S.A. (1) 314 5010 **Australia**—Megatec Pty, Ltd. 1 800 806 563 **Austria**—SIS Informationstechnologie Ges.m.b.H (01) 376316112 **Benelux**—Computing & Systems Consultants bv (040) 43 49 57 BMC Software Services (070) 360 68 60 **Brazil**—Brazil Software (021) 533 1726 Nutec Informática S.A. (011) 505 5728 **Chile**–Digital Equipment America Latina (2) 671 8161 S & A Consultores (2) 235 0289 **Czech Republic**—INSEKO CS (067) 607 311 **Denmark**—Tempest Europe ApS 4494 8902 **Finland**—TT-Professional Solution Oy (90) 502 7612 **France**—ADE (Toulouse) (16) 61 73 32 49 **Germany**—GFKT Wick Hill GmbH (040) 23 73 01 0 **Hong Kong**—G.T.I. 2753 8283 **Ireland**—Entropy Ltd. (01) 2940199 **Israel**—Lihad/Bina Systems Ltd. (03) 557 3636 **Italy**—Siosistemi srl (030) 24411 **Japan**—Cybernet Systems (03) 5978 5410 **Malaysia**—SCS Computer Systems Sdn. Bhd (03) 756 5800 **Mexico**—Infosistemas Financieros (5) 813 1325 **New Zealand**—Interconnect (09) 358 0322 **Norway**—Nocom Norge A/S 67581450 **Poland**—Softkom Sp. z o.o. (2) 6356346 **Portugal**—Silicon (01) 795 85 85 **Singapore**—ST Computer Systems & Services Ltd. 441 2688 **Slovak Republic**—INSEKO a.s. (089) 64 88 08 **South Africa**—LAN Design (011) 444 1050 **Spain**—Scorpion Sistemas SA (93) 485 40 44 **Sweden**—Nocom AB (018) 65 55 00 **Switzerland**—Commcare (01) 730 24 31 **United Kingdom**—Wick Hill Ltd. (01483) 772280 **Venezuela**—Lanka Sistemas (2) 959 2411

WRQ Reflection

CONNECTIVITY FOR A CHANGING WORLD

WALKER RICHER & QUINN, INC. / 1500 DEXTER AVENUE NORTH, SEATTLE, WASHINGTON 98109 USA / FAX: 206.217.0293
▲ BUITENHOF 47, 2513 AH DEN HAAG, THE NETHERLANDS / FAX: +31.70.356.12.44 ▲ WILHELM-MARX HAUS, HEINRICH-HEINE ALLEE 53, 40213 DÜSSELDORF, GERMANY / FAX: +49.211.8307 360 ▲ LE DÔME, BP 10910, 1 RUE DE LA HAYE, 95731 ROISSY CDG CEDEX, FRANCE / FAX: +33.1.49.19.22.16 ▲ WRQ AND REFLECTION ARE REGISTERED TRADEMARKS OF WALKER RICHER & QUINN, INC.
ALL OTHER TRADEMARKS ARE THE PROPERTY OF THEIR RESPECTIVE HOLDERS.

NEC NEWSCOPE

NEC VERSA® 4000: THE MOST INNOVATIVE MULTIMEDIA NOTEBOOK

There are three keys to the superior performance of the VERSA 4000: super-fast Pentium® processing, unmatched modularity, and advanced multimedia functionality. The core of the system is a 90MHz or 75MHz Pentium processor, with the latest energy-saving technology.

Its extraordinary versatility comes from the innovative VersaBay™ II. This front-loading slot lets users customize the notebook by slipping in their choice of modules: a CD-ROM drive, floppy drive, second lithium ion battery or second hard drive.

Versa's multimedia capabilities fully meet the needs of today's mobile professionals. With a choice of large 10-plus inch TFT color screens, with resolutions up to 800 x 600, the VERSA 4000 can display presentations in up to 16.8-million colors. Other multimedia features include two stereo speakers, microphone, Sound Blaster® Pro-compatible stereo sound system, four audio ports, volume-control dial and full-motion video support.

The VERSA 4000 also has two PC Card slots and complete desktop-docking capabilities. Two infrared ports support printing and file transfer. Users can expand the standard 8MB memory up to 40MB: 540MB/810MB disk storage up to 1GB. Pre-installed software includes Windows® 95.

C&C for Human Potential

All trademarks are property of their respective holders.

"Connect!"
Updates on the scope and depth of NEC technologies
Number 157
TELECOM 95
GENEVA 3-11 OCTOBER 1995

DIGITAL INTERACTIVE SERVICES VIA COPPER PAIR

Telstra of Australia is implementing a pilot program to deliver interactive video services over existing telephone copper pair cables to 300 subscribers in Melbourne. The enabling technology is called ADSL, Asymmetric Digital Subscriber Line technology.

As prime contractor for the project, NEC Australia is responsible for system design, equipment supply and overall integration. Key equipment includes video servers, MPEG encoders, switches, ADSL line cards, and set-top boxes.

The pilot program will use two types of ADSL transceivers: 2Mbps Carrierless Amplitude Phase units and 6Mbps Discrete Multi-Tone units. The system will deliver live and stored video programs to support both Pay-per-View and Video-on-Demand services.

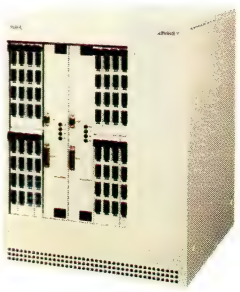
The system architecture is among the world's most advanced in terms of scalability and openness to future enhancements. It accommodates both new subscribers and multiple video information providers.

The system can be upgraded to provide a wide range of interactive multimedia services. They include home shopping, travel services, directories, databases, video games and instructional/educational programs.

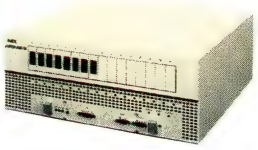
NEW ENTERPRISE ATM SWITCHES

Many enterprises are enhancing communications with LANs based on ATM technology. To meet diverse user needs, NEC has expanded its lineup with two new enterprise ATM switches, ATOMIS 5E and ATOMIS 7E.

ATOMIS 5E features throughput of 2.5Gbps. It supports interfaces of OC-3/STM-1, TAXI, DS3, E3, and 6.3Mbps. ATOMIS 7E offers maximum throughput of 10Gbps. It further supports OC-12/STM-4.



ATOMIS 7E



ATOMIS 5E

To maximize network reliability, ATOMIS 7E features redundant switches and controllers.

Both enterprise switches support a full SNMP agent. This enables integrated network management of LAN equipment such as routers and hubs. Both switches comply with ITU-T, ATM Forum and other international standards.

NEC has also introduced ATOMVIEW, a sophisticated system for integrated management of ATM networks. ATOMVIEW automatically recognizes network structure and collects traffic data. Its graphical display simplifies maintenance and control operations. ATOMVIEW complies with the latest ATM Forum standard for Call Admission Control.

NON-LINEAR MO EDITING SYSTEM

Tapeless, non-linear program editing is a major advance in TV broadcast technology. NEC has introduced a smart, simple, PC-based system that allows users to take advantage of the vast capacity of magneto-optical (MO) disks.

Our non-linear editing system centers around a compact MO video disk recorder and a 23-GByte MO disk. The 30cm disk records 32 minutes of uncompressed NTSC video and audio, or 38 minutes of PAL video and audio.

The VF-200 MO video disk recorder offers many advantages. Real random access allows you to select start-points, end-points and sequencing at will. You can edit and transmit during recording. It permits separate editing of high-quality video/audio and still/slow playback. You can remove disk cartridges for permanent storage.

NEC's non-linear MO editing system is a versatile performer, designed for on-line news and sports as well as off-line applications.

NEC

For further information, please contact: The Newscope Center, Overseas Advertising Division, NEC Corporation 7-1, Shiba 5-chome, Minato-ku, Tokyo 108-01, Japan Fax: +81-3-3798-6333

EDITOR IN CHIEF
Raphael Needleman

Editor in Chief's Assistant: Linda Higgins

EXECUTIVE EDITORS
Rich Friedman, Jon Udell

MANAGING EDITOR
Lauren Stickler Thompson

NEWS
Peterborough:
News Editors: David L. Andrews, Martha Hicks
New York:
News Editor: Salvatore Salamone
San Mateo/West Coast:
Senior Editor: Tom Halfhill
Frankfurt:
Senior Editor: Rainer Mauth

PRODUCT REVIEWS
Director: Stanford Diehl
Senior Technical Editors: Rick Grehan, Douglas Tamasanis
Technical Editors: Rex Baldazo, Susan Colwell, David Essex, Dave Rowell
Reviews Assistant: Lisa O'Neil

STATE OF THE ART/FEATURES
San Mateo:
Features Editor: John Montgomery
Peterborough:
Senior Editor: Alan Joch
Technical Editor: Russell Kay
Lexington:
Senior Editor: Edmund X. DeJesus

SENIOR TECHNICAL EDITOR
At Large: Tom Thompson

SENIOR RESEARCHER
Rowland Aertker

ASSOCIATE TECHNICAL EDITORS
Dennis Barker, Cathy Kingery, Mark Reynolds, Warren Williamson

SENIOR CONTRIBUTING EDITOR
Jerry Pournelle

CONTRIBUTING EDITORS
Stephen Apiki, Dick Pountain

CONSULTING EDITORS
Nicholas Baran, Raymond GA Côté, Trevor Marshall, Stan Miastkowski, Barry Nance, Roberta Pournelle, Ellen Ullman, Peter Wayner

EDITORIAL ASSISTANTS
Tammy Grenier, June Sheldon

EDITORIAL INTERN
Jeff MacClay

DESIGN
Design Director: Charles Dixon III
Associate Design Director/Design & Photography: Sharon Price
Associate Design Director/Graphics: Joseph A. Gallagher
Production Manager: David R. Anderson
Desktop Prepress Manager: Virginia Reardon
Designers: Barbara Busenbark, Jan Muller, Donna Sweeney
Design Assistant: Cindy Sands

FINANCE AND OPERATIONS
Director: Claudia Flowers

ADVERTISING PRODUCTION
Advertising Production Manager: Linda Fluhr
Senior Advertising Services Representative: Lyda Clark
Advertising Services Representatives: Dale J. Christensen, Karen Cilley, Rod Holden
Operations Assistant: Lisa Jo Steiner
Advertising Graphics Manager: Susan Kingsbury
Graphics Production Coordinator: Christa Patterson

FINANCE
Senior Financial Analyst: Kathleen Deguise
Systems Administrator: Peggy Dunham
Junior Financial Analyst: Diane Henry

ADMINISTRATION
Human Resources Administrator: Patricia Burke
Receptionist: Agnes Perry

MARKETING AND PLANNING
Marketing Manager: Rob Mitchell
Marketing Art Director: Stephanie Warnesky
Market Research Manager: William Zhao
Copyrights Manager: Faith Kluntz
Assistant Manager, Marketing Events: Carol Sanchioni
Marketing Services Administrator: Meredith Bickford

CIRCULATION
Circulation Manager: Paul Ruess
International Circulation Manager: Barbara Copcutt
Subscriptions Manager: Lynn Lagasse
Subscription Source Specialist: Christine Tourgee
Newsstand Manager: Vicki Weston
Assistant Manager: Karen Desroches
Back Issues: Jill Wood

PUBLISHER
David B. Egan

Publisher's Assistant: Donna Nordlund

ADVERTISING SALES
VP/Sales:
John M. Griffin **(212) 512-2367**
Peterborough, NH **(603) 924-2663**
Administrative Assistant:
Terry Ouellette **(603) 924-2635**

NEW ENGLAND
Sanford L. Fibish **(617) 860-6344**
Merle Model **(617) 860-6221**

MID-ATLANTIC
Michael Feinberg **(212) 512-4811**
Margot Swanson **(603) 924-2651**

MIDWEST
Lori Silverstein **(614) 899-4908**
Kevin Lary **(614) 899-4909**
Ed Ware **(603) 924-2664**

SOUTHWEST, ROCKY MOUNTAIN
Jennifer Walker **(214) 701-8496**
Kevin Lary **(614) 899-4909**
Ed Ware **(603) 924-2664**

SOUTH PACIFIC
Beth Dudas **(714) 753-8140**
Mark Speros **(714) 753-8140**

NORTH PACIFIC
Roy J. Kops **(415) 513-6861**
Susan Rastellini **(415) 513-6951**

NEW MEDIA/ON-LINE PRODUCTS
Brad Dixon **(603) 924-2574**

INSIDE ADVERTISING SALES
Advertising Director:
Diane Lieberman
Assistants: Susan Monkton, Vivian Bernier

REGIONAL
Brian Higgins **(603) 924-2596**

BYTE DECK
Brian Higgins **(603) 924-2596**

EURO-DECK
Joseph Mabe **(603) 924-2533**

REPRINT SALES
Susan Monkton **(603) 924-2618**

INTERNATIONAL ADVERTISING SALES STAFF
Director: L. Bradley Browne
Administrative Assistant: Arja Neukam
See listing on page 245.

How to Contact the Editors

We welcome your questions, comments, complaints, kudos, and submissions.
MAIN OFFICE: One Phoenix Mill Lane, Peterborough, NH 03458, (603) 924-9281.
San Mateo: 1900 O'Farrell St. #200, San Mateo, CA 94403, (415) 513-6912.
New York: 1221 Avenue of the Americas, New York, NY 10020, (212) 512-3588.
Lexington: 24 Hartwell Ave., Lexington, MA 02173, (617) 863-5100.
GERMANY/EUROPE: Liebigstrasse No. 19, 60323 Frankfurt, Germany, +49 69 7140 7123.
ELECTRONIC MAIL: On BIX, send to "editors." All BYTE editors and columnists also have individual mailboxes on BIX for easy access.
MCI: 250-0135 BYTE Magazine. Many editors also have individual MCI addresses in their own name.
OTHERS: Many editors also are reachable through uunet, AppleLink, CompuServe, and numerous other services.
WEB: http://www.byte.com
U.S. fax: Editorial: (603) 924-2550
Advertising: (603) 924-7507
U.K. fax: +44 171 495 6734

SUBMISSIONS:
Authors: We welcome article proposals and submissions. Unacceptable manuscripts will be returned if accompanied by sufficient return postage. Not responsible for lost manuscripts or photos.
Vendors: We welcome news of your new products; please call the News department or the BYTE Lab at the earliest possible date. We cannot be responsible for unsolicited product samples.

ARTICLE REPRINTS: For price quotations on customized reprints of BYTE articles, contact Susan Monkton, reprints manager, at (603) 924-2618. (Minimum quantity: 500.)

Subscription Customer Service

Inside U.S. (800) 232-BYTE; outside U.S. +609 426 7676. E-mail-based customer service: mpcstsvc@mcgraw-hill.com, Web-based customer service: http://www.mcgraw-hill.com/multipub. International subscribers may also contact our international customer service facility in Galway, Ireland, by calling +353 91 752792 or via fax: +353 91 752 793. **For a new subscription, (800) 257-9402** U.S. only, E-mail: mporders@mcgraw-hill.com or write to BYTE Subscription Dept., P.O. Box 555, Hightstown, NJ 08520. Subscriptions are $29.95 for one year, $54.95 for two years, and $74.95 for three years in the U.S. and its possessions. In Canada and Mexico, $34.95 for one year, $64.95 for two years, $87.95 for three years. In Europe, £42 (US$60) for fast surface delivery, £55 (US$80) for air delivery. Non-European countries US$60 for surface mail, or US$85 for air mail. Single copy price is $3.95 in the U.S. and its possessions, $4.95 in Canada. Foreign subscriptions and sales should be remitted in U.S. funds drawn on a U.S. bank. Please allow six to eight weeks for delivery of first issue.

PHOTOCOPY PERMISSION:
Where necessary, permission is granted by the copyright owner for those registered with the Copyright Clearance Center (CCC), 222 Rosewood Dr., Danvers, MA 01923, to photocopy any article herein for personal or internal reference use only for the flat fee of $1.50 per copy of the article or any part thereof. Correspondence and payment should be sent directly to the CCC, 222 Rosewood Dr., Danvers, MA 01923. Specify ISSN 0360-5280, $1.50. Copying done for other than personal or internal reference use without the permission of The McGraw-Hill Companies, Inc., is prohibited. Requests for special permission or bulk orders should be addressed to Faith Kluntz, copyrights manager, (603) 924-2525. BYTE is available in microform from University Microfilms International, 300 North Zeeb Rd., Dept. PR, Ann Arbor, MI 48106 or 18 Bedford Row, Dept. PR, London, WC1R 4EJ, U.K.

BYTE
A Division of the McGraw-Hill Companies

Copyright © 1995 by The McGraw-Hill Companies, Inc. All rights reserved. BYTE and BYTE are registered trade-marks of The McGraw-Hill Companies, Inc. Trademark registered in the United States Patent and Trademark Office.

Member Audit Bureau of Circulation

BIX Interactive On-line Service

MANAGING EDITOR
Christine Taylor

EXCHANGE EDITORS
Amiga Exchange: Joanne Dow
Entertainment and Leisure Exchange: Rich Taylor
IBM Exchange: Barry Nance
Programmers Exchange: Bill Nicholls
Professionals Exchange: David Reed
Tojerry Exchange: Jerry Pournelle
WIX Exchange: Karen Kenworthy
Writers Exchange: Wayne Rash Jr.

TECHNICAL ASSOCIATE
Mark Lavi

MEMBER SERVICES MANAGER
Kevin Plankey

BIX, owned and operated by Delphi Internet Services Corporation, is a worldwide, low-cost, on-line information service featuring industry news, downloadable software, powerful electronic mail, previews of upcoming BYTE articles, the full text of published issues of BYTE, and source and/or executable code for BYTE benchmarks and noncommercial software mentioned in feature articles. BIX also offers unmatched "conferences" on virtually every computer-related topic imaginable, where you can share information with thousands of other computer pros. To subscribe via modem, set your communications software to full duplex, 7 bits, even parity, 1 stop bit, and then call (800) 695-4882 or (617) 491-5410, or telnet to x25.bix.com and type "bix" at the USERNAME prompt. At the Name? prompt, type bix.ville. For more information, call (800) 695-4775 or (617) 354-4137 (voice); send a fax to (617) 491-6642; or send Internet mail to info@bix.com.

OFFICERS OF THE MCGRAW-HILL COMPANIES, INC.:
Founder: James H. McGraw (1860–1948).
Chairman and Chief Executive Officer: Joseph L. Dionne; *President and Chief Operating Officer:* Harold W. McGraw III; *Senior Executive Vice President, and Secretary:* Robert N. Landes; *Senior Vice President and General Counsel:* Kenneth M. Vittor; *Executive Vice President and Chief Financial Officer:* Robert J. Bahash; *Senior Vice President, Treasury Operations:* Frank D. Penglase; *President, Information Services Group:* Michael K. Hehir; *Executive Vice President, Publication Services:* Norbert Schumacher.

PRESENTING THE
PHOTON™
microGUI
AT THE EMBEDDED SYSTEMS CONFERENCE
Booth 1433

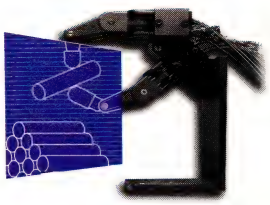
QNX®

The Leading Realtime OS for PCs

So you've chosen Intel® processors for your embedded systems. Smart choice, given the great variety of form factors, buses, and software support for non-desktop PCs. Now go with the leading realtime OS for PCs.*

With QNX's successful 14-year track record and huge installed base, you can count on a realtime OS that's been proven time after time in the real world.

Embeddable GUI



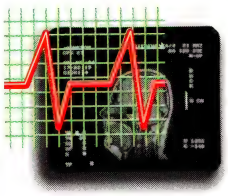
And if you're looking for a full-featured windowing system in a very small package (under 300 K), look no further than Photon,™ the world's first microkernel GUI for embedded systems.

Scale it on the Fly

As a modular, microkernel-based OS, QNX lets you add or subtract modules to fit your platform —from PDAs up to workstations equipped with X and TCP/IP. You can start and stop modules at run time *without rebooting your system!* Even our runtime pricing is modular, so you pay for only the OS modules used in your target systems.

Embedded and Distributed

Beyond mere connectivity, QNX provides true distributed processing. Your embedded system can become part of a fault-tolerant network with resources you can control from any PC throughout the LAN. Whether you're doing remote debugging, or accessing X applications from a PDA, it's all remarkably easy with QNX.



Open Embedded Systems

QNX is the *certified* POSIX OS that performs like a dedicated real-time executive. You get the rich API and tools of an open-systems OS, all in a scalable package that can fit on everything from tiny ROM-based systems to vast distributed LANs.

You'll like the tighter, faster code you get with the Watcom C/C++ optimizing compiler. Not to mention the time you'll save with our distributed debugger, profiler, and trace analysis tools.

From PC/104 to PCMCIA

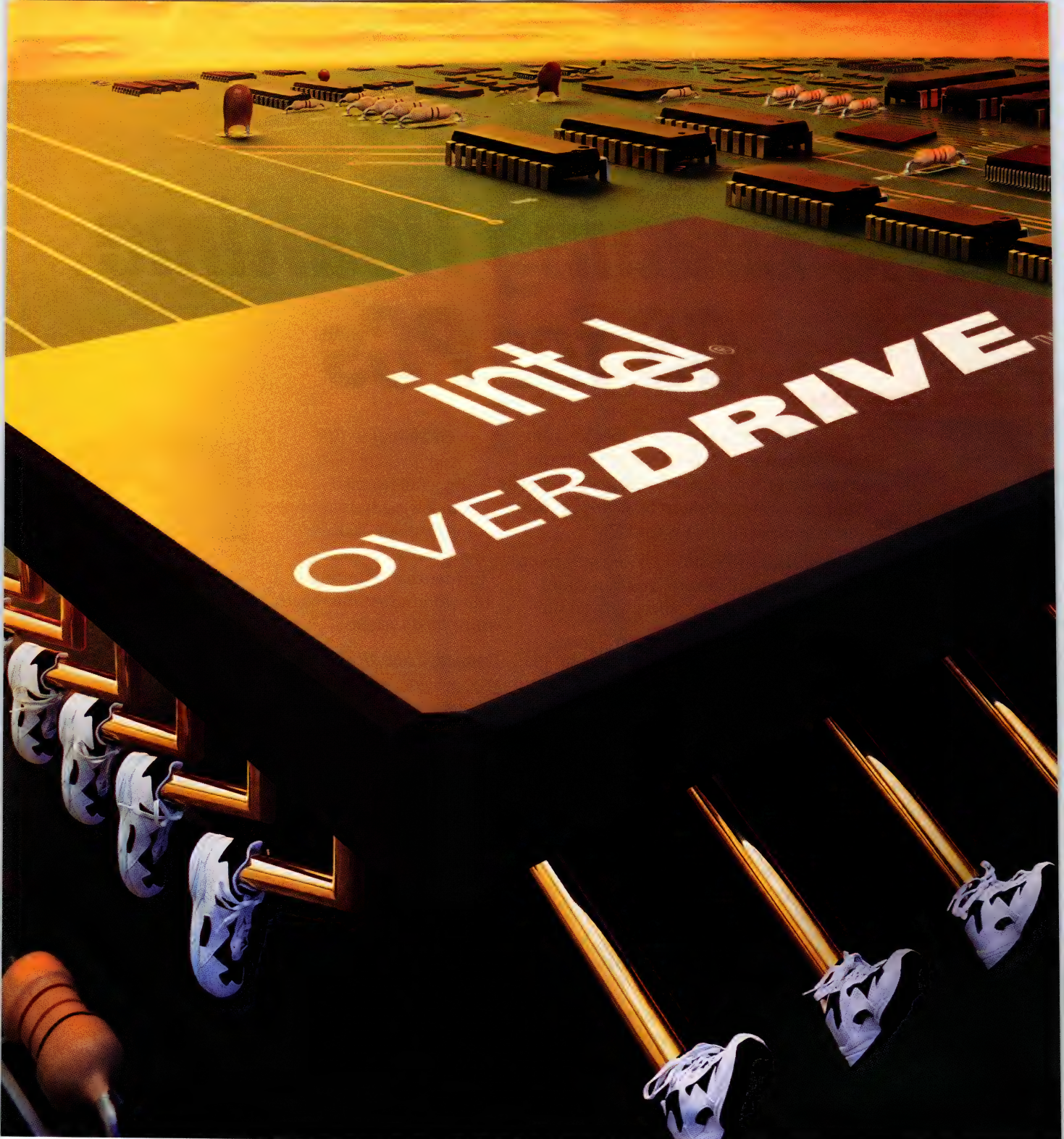
QNX runs on several buses — PC/104, STD, STD 32, VME — and embedded PCs from Adastra, Ampro, Octagon, Xycom, Radisys,Teknor, VMIC, WinSystems, and Ziatech. We also support the i386EX processor, as well as industry standards such as PCI and PCMCIA.

To find out more about the leading realtime OS for PCs, contact us at info@qnx.com or http://www.qnx.com or call **800-676-0566.** ***(EXT. #1008)***

- **Leading in Experience** *(Realtime OS for PCs since 1981)*
- **Leading in Innovation** *(Microkernel distributed OS for PCs since 1984)*
- **Leading in Market Share** *(QNX outsells every other realtime OS for PCs)*

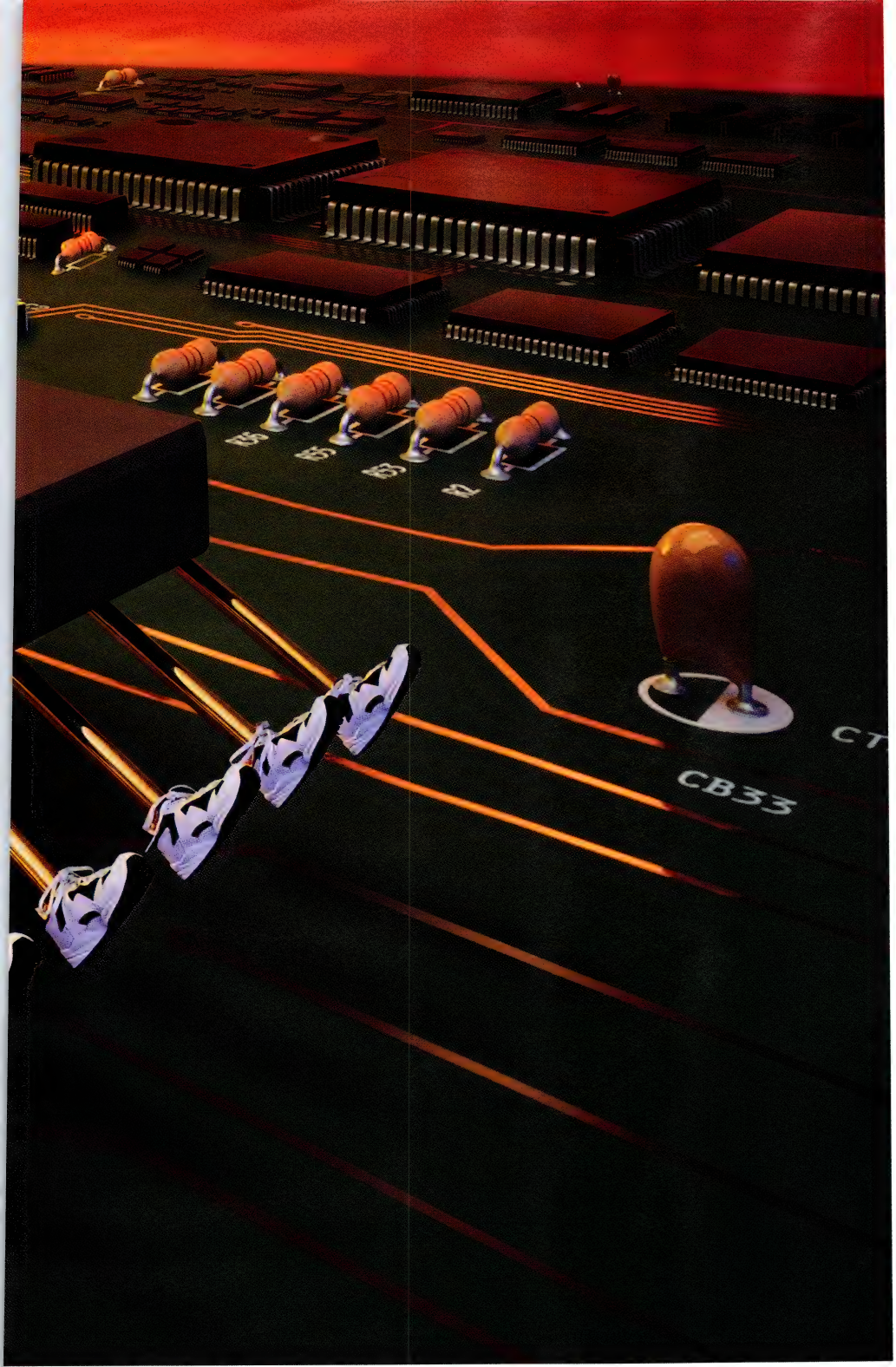
QNX Software Systems Ltd., 175 Terence Matthews Crescent, Kanata, Ontario, Canada K2M 1W8 Voice: 613-591-0931 Fax: 613-591-3579 Email: info@qnx.com Web: www.qnx.com
Europe: 17 Bishops Court, Church Road, Bishopstoke, Hampshire, SO5O 6PE, England Voice: (+44) 1703 611800 Fax: (+44) 1703 641153 Email: QNXeurope@qnx.com
*According to a recent report by Emerging Technologies Group, QNX has "the largest realtime operating system marketshare in the Intel® 80X86 marketplace."
© QNX Software Systems Ltd. 1995. QNX is a registered trademark and Photon is a trademark of QNX Software Systems Ltd. All other trademarks belong to their respective owners.

Circle 91 on Inquiry Card.



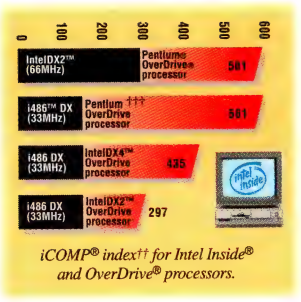
©1995 Intel Corporation. †The 63-MHz Pentium OverDrive processor for most 50-MHz and 25-MHz Intel486 CPU-based systems is available now. The 83-MHz Pentium OverDrive processor for most 66-MHz and 33-MHz Intel486 CPU-based syste
ratings are for processors running in write-back mode. i486™ processor-based systems supporting the write-through mode will yield approximately 15% lower iCOMP index ratings when upgraded with the Pentium OverDrive processor. *Other trade nan

Run your PC faster with the Over



An Intel OverDrive® processor is a single-chip upgrade that increases performance of most Intel486™ CPU-based PCs. This translates into better software performance.

From the newest and fastest member of our family, the Pentium® OverDrive processor,† to our IntelDX4™ and IntelDX2™ OverDrive processors, we offer you a range of highly affordable upgrade solutions.



iCOMP® index†† for Intel Inside® and OverDrive® processors.

An OverDrive processor can boost CPU performance as much as 250%.

http://www.intel.com/procs/ovrdrive/

To learn more about Intel OverDrive processors, visit our Web site, dial our FaxBack number at 1-800-525-3019, doc. #9306, or call 1-800-538-3373, ext. 295.*

l be available in September, 1995. ††Source: iCOMP®: A Simplified Measure Of Relative Microprocessor Performance. Intel Corporation, 1992. †††Pentium OverDrive processor iCOMP
erenced are the property of their respective holders.

Drive® processor upgrade. intel®

LETTERS

The Inelegant Kludge

I'm a bit confused by your article on Windows 95, "The Elegant Kludge" (August). The title and first two paragraphs seem to set the tone: Windows 95 is still "just" Windows. The "Windows 95: Head-to-Head" matrix (page 54) clearly shows that OS/2 Warp Connect is the superior choice. Then after lots of words describing the architecture of Windows 95, you conclude that I still should buy it because it has a slick user interface. Or worse yet, if I want a "real" 32-bit operating system, I should consider Windows NT. If Windows 95 is half-baked, why should I believe that the same cook didn't forget something in the baking of Windows NT as well? I'm not sure if it was the author's intention, but I think OS/2 Warp may be worth looking at now.

Doug Carter
dougc@clam.com

Telling It Like It Is

Bravo! Your August cover story delivered the first honest and complete coverage of what Windows 95 is and isn't. Win 95 is an important stepping stone to the next (real) operating system for Intel-based PCs. I picked up an extra copy of the issue to distribute around the office (I want to keep mine in one piece).

Dick Womack
Senior finance systems support analyst
Pepperdine University
dwomack@pepperdine.edu

Why Did Win 95 Win?

In your News & Views story "Network and Windows 95 Take Top BYTE Awards" (July), you state that the editors voted Windows 95 as the Best Operating System and the Best of Show because "This was the first Comdex at which Windows 95 was in full display on the show floor." I was under the impression that BYTE gives something the Best of Show prize at Comdex because of its outstanding quality and usability, not because its manufacturer plasters it everywhere, forcing others to follow or go out of business. This is nearly as sad as seeing BYTE's Web server use 8.3 filenames.

Szabolcs Szigeti
pink@fsz.bme.hu

Windows 95 is not perfect, but it is a pretty good step toward dragging the huge Windows installed base into a 32-bit future. And some of the 32-bit apps that Win 95 enables will be powerful, innovative, and just plain neat.—Eds.

OS/2 or Not OS/2

I have been a BYTE subscriber for years, but I was upset with the August issue. Of the three articles listed in the Contents by Platform index as OS/2 articles, two were actually about Windows 95 and one was about Lotus Notes. The shift in your editorial stance to ignore a major operating system has led me to feel deserted by BYTE. I realize that you have to cover Windows 95, as it is "hot" news. But to disguise those articles as OS/2 articles is insulting to those of us who use OS/2 and have no plans to change to Windows 95.

Steve Shultz
72073.1673@compuserve.com

Blasts in the Past

In the August issue, "The Last Blasts Quiz" seems to imply that there will not be any more Blasts from the Past page. That would be very disappointing. I think the Blasts column is one of the most valuable in BYTE, and I hope it can continue. It gives us a perspective on what everyone used to think was the latest thing.

Duke Briscoe
duke@harlequin.com

Blasts from the Past was a special column to help us and our readers prepare for our 20th anniversary issue, which we published last month.—Eds.

GNU Is Gnot Gnarly

In his Code Talk column entitled "ANSI C Anywhere" (June), Rick Grehan wrote of how difficult it is to port the GNU C/C++ compiler and how easy it is to create a new C compiler using a different set of tools. GNU C/C++ is just like those other tools, requiring a target machine file and machine description file. I was able to have a bug-free GNU compiler for the Hitachi-HD16 processor in four days. And the GNU C/C++ outperforms most optimizing compilers.

Kerwin F. Medina
via e-mail

I personally found the GNU documentation difficult to follow. It could have improved since I saw it; it could also be that I simply didn't have the mental horsepower necessary. In any case, I am happy to hear that you had such an easy time of it. I applaud the entire concept behind GNU products.
—Rick Grehan, senior technical editor
rick_g@bix.com

Unfriendly Reader Interface

I don't mean to be a Luddite, but I hope the new background/foreground color schemes you used in your cover story "Inside the Mind of Microsoft" (August) are not a harbinger of future BYTE graphics. The dark-shaded text boxes were very hard to read except in perfect lighting conditions. Are you attempting to emulate certain newly arrived cyberzines? If so, please reconsider!

Jim Wheelock
New York, NY

Agreed. In the future, we will try to make our articles easier to read.—Eds.

Totally RAD, Dude

I found "The End of Programming" (August) very helpful. Having just taken a PowerBuilder class (but not having built anything with it yet), your warnings and suggestions are well-taken advice regarding how to best use the RAD (rapid application development) technology. I plan to keep a copy of your article with my manuals.

Mike McIntosh
Mike_McIntosh@sysprog-ada.ccmail.compuserve.com

We want to hear from you. *Address correspondence to Letters Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458; or you can send E-mail via the Internet or BIX to editors@bix.com. Letters may be edited.*

Looking For A Simulation System That Has It All?

...t is with great satisfaction that I can recom-...end Taylor II to potential users of simulation ...ftware. We have recently purchased this excel-...t package and believe it to be a powerful pro-...ctivity tool for the industrial engineer. The ...ckage features are superb, and the entry price ...r the software is reasonable. We look forward to ...any years of benefit from this package: Taylor II ... a major development for industrial engineers. ...e package is good, the support service and the ...aining courses are first class. Taylor II is simply ...e best."

Jim O'Neill
Industrial Engineering Manager
Waterford Crystal Limited, Ireland

...There is only one thing I regret about owning ...aylor II: I wish I had owned it sooner."

G. Molloy
Conner Peripherals
USA

...The product is as pragmatical as the service, ...hich makes Taylor II an excellent business tool."

T. Veltman
KLM Royal Dutch Airlines

"In our search for a simulation software, we found Taylor II to be the most complete package at the best price. The sales person presented us with an inhouse demonstration that was far more interesting and informative than any of the others given to us. Most importantly, their customer service clinched the sale. Their technical support, users conferences and newsletters are all superior to those of their competitors!"

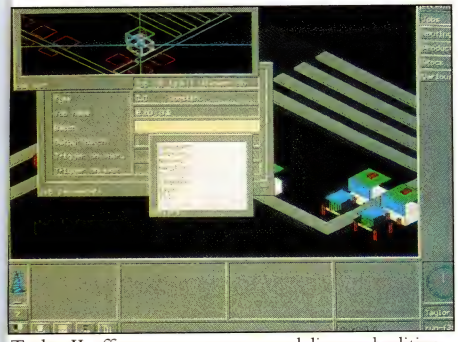
Edward Nisbet,
Senior Industrial Engineer
Philips Consumer Electronics

BEST OF BYTE CeBIT '95

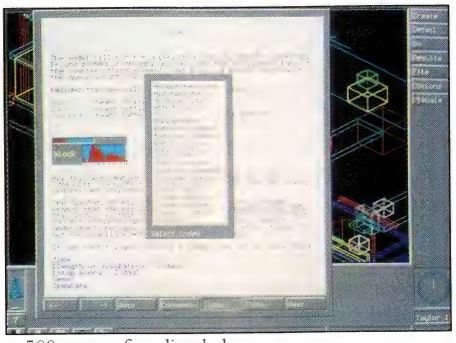
WINNER

At this year's Cebit, the editors of Byte Magazine awarded Taylor II as 'Best application software of Cebit 1995'.

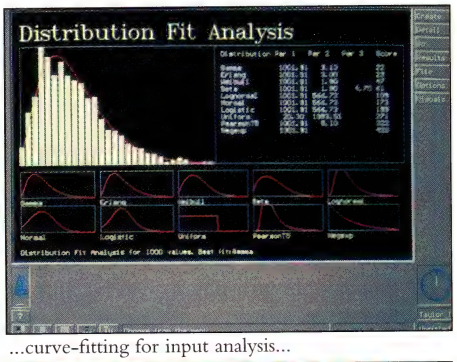
I've Got What You're Looking For...



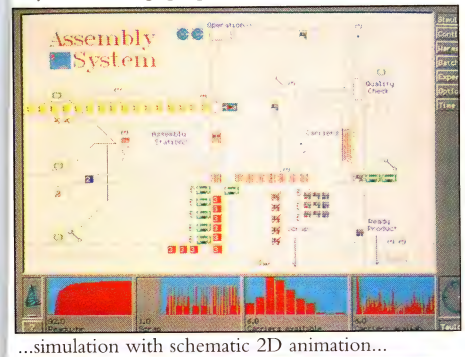
Taylor II offers pop-up menu modeling and editing...



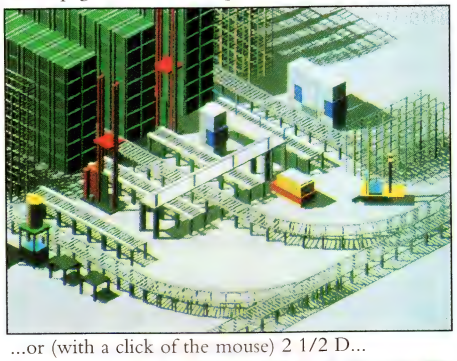
...500 pages of on-line help...



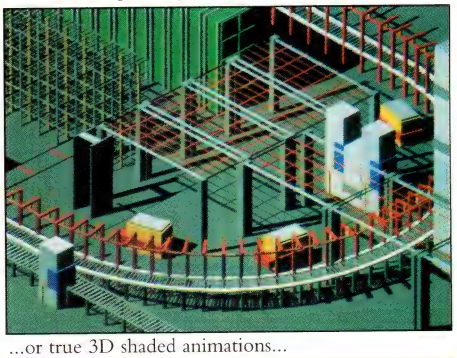
...curve-fitting for input analysis...



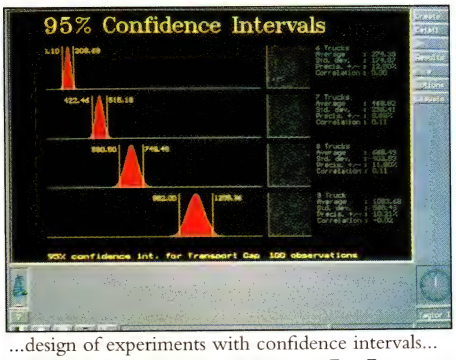
...simulation with schematic 2D animation...



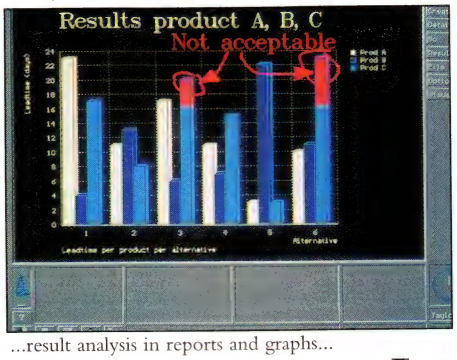
...or (with a click of the mouse) 2 1/2 D...



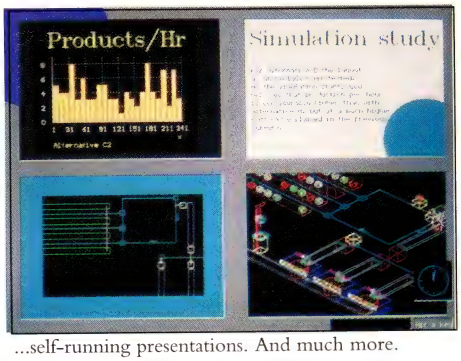
...or true 3D shaded animations...



...design of experiments with confidence intervals...



...result analysis in reports and graphs...



...self-running presentations. And much more.

Taylor II - Manufacturing and Logistics Simulation

F&H Simulations: Software, Training and Consultancy - For more information, in-company presentations or the free demo disk, call F&H Simulations.
Europe: F&H Simulations B.V. - Spoorlaan 424 - 5038 CG Tilburg - The Netherlands - Phone: +31 13 366344 - Fax +31 13 427516 - Germany: Phone: +49 211 322151 - Fax: +49 211 322897 - U.K.: Phone +44 71 4300945 - Fax: +44 71 4051689 - U.S.A.: F&H Simulations Inc. - P.O. Box 658 - Orem 84059, Utah - Phone: (801) 224-6914 - Fax: (801) 224-6984

Circle 531 on Inquiry Card.

Slight Misunderstanding

There is a small error in Tom Thompson's feature story "Apple's New Operating System" (June). He asserts that Copland's hardware abstraction layer is "a feature currently found only in Windows NT." In actual fact, IBM's OS/400 and its predecessor S/38 CPF have been based on a HAL since the first S/38 was introduced in the early 1980s.

David Welden
Newport Beach, CA

Our article was describing a new desktop OS, so we were comparing it with other desktop OSes. Just as NT and Copland will probably not appear on an AS/400, OS/400 is not going to be running on a PowerPC or Intel desktop machine anytime soon.

—Tom Thompson, senior technical editor, tom_thompson@bix.com

Make the Senders Pay

I agree with Nick Baran's Commentary ("Stop, Look, and Listen!," August). Billions of dollars are going to be wasted as companies try to launch poorly considered information services. Forget the notion that people will pay to receive information. Look instead at industry models where senders carry the brunt of the costs, such as advertising-driven media like TV and radio broadcasting or newspaper and magazine publishing. We need new industry models that support distribution of digital information from paying senders. Invest those billions of dollars, but in services that we as customers want and can afford.

Peter Ruhe
peterr@wimsey.com

Lighten Up on Microsoft

I was very impressed by Rafe Needleman's editorial on Microsoft ("Why I Love/Hate Microsoft," August). I have always felt that those who bashed Microsoft for the way it does business were simply suffering sour grapes. They were upset at the fact that they didn't market their products or ideas as well as Microsoft does.

Gerry O'Brien
Moncton, New Brunswick, Canada
gerryobr@nbnet.nb.ca

I am amused by the resentment and furor emanating from Microsoft bashers. In your recent editorial, I sense that you dislike the company when you use phrases such as "Evil Beast" and "corporate arrogance." If Microsoft does not understand the corporate market, it can hardly be called arrogant. Ignorant, perhaps, but not arrogant. Windows is not perfect, but neither is anything else created by human beings. Show me a DOS, Mac, or OS/2 user who never had to reboot his or her computer and I will show you a bridge for sale.

Gary Wong
Oakland, CA

Amiga Redux

I was surprised to see an article essentially devoted to LightWave3D ("Desktop Hollywood F/X," July). I guess this is because it is now available for real personal computers (sarcasm intended) and not some obscure toy like the Amiga, which was four to five years ahead of its time. In your list of company addresses, you included Commodore Business Machines, but Commodore has been out of business for over a year now. The Amiga is now owned by Amiga Technologies GmbH, a part of Escom AG.

Zoltan Hunt
Downsview, Ontario
am609@freenet.toronto.on.ca

Amiga fans, rejoice! German company Escom AG has acquired Commodore Electronics Ltd. and Commodore's Amiga technology. Escom's plans reportedly include producing the Amiga 600, 1200, and 4000 series and melding Amiga and MS-DOS systems. Here's the contact info: Escom AG, Tiergarten Strasse 9, Heppenheim, Germany 64646; +49 6252 7090; fax +49 6252 709 442.

—Ed DeJesus, senior editor edejesus@bix.com

GSM Is Not MSG Backward

It was nice to read your "Special Report on Mobile Computing" (June). As a reader living outside the United States, I noticed that there was no mention of GSM, the global system for mobile communications. I have heard rumors that some GSM operators will start soon in the U.S. It would be nice to read about it and how companies are using it. GSM provides 9600-bps connections, which are not the most efficient, but better speeds are coming.

Jan Laakso
jan.laakso@cc.tut.fi

GSM is very popular in Europe. Unfortunately, I leave my mobile phone here when I travel abroad because the standards are different. I would gladly trade my phone for a GSM unit if I could get GSM services in the U.S.

—Rafe Needleman

FIX

Due to an editing error, our article "The Elegant Kludge" contains a mislabeled diagram describing OS/2 Warp's memory model (August, page 56). The two boxes labeled VxD should be labeled VDD. We regret the error. ■

COMING UP IN NOVEMBER

- **ENTERPRISE DATABASES**
  We look at industrial-strength databases for the desktop: Oracle for OS/2, DB/2 for OS/2, and Microsoft SQL Server for Windows NT.
- **ZAPPED!**
  We report on our tests of uninterruptible power supplies (UPSes) that not only provide the juice but can communicate with your PC for controlled shutdown.
- **WORKSTATIONS**
  More reviews of Windows NT workstations, including an Alpha 21164 and a new crop of PowerPC systems.
- **LET YOUR NETWORK DO THE WALKING**
  Directory Services help bring ever-larger and complex networks under control.
- **SIMULATING BUSINESS**
  How Siemens Solar Industries has made extensive use of simulations as part of its effort to reengineer business processes.

EVOLUTION MEETS REVOLUTION.

You've evolved. You've got Microsoft® Windows® 95*. But don't stop there. Move up to the revolutionary multimedia Win 95 products from Creative Labs. You'll get next generation performance, plus radical ease of installation.

Start with our next generation Sound Blaster® AWE32™ PnP. This top of the line sound card gives games and multimedia applications renewed life with real instruments, sounds and digital effects processing. What's more, you'll experience Creative 3D Stereo Enhancement Technology to put you in the middle of AWE32's incredible wave-table sounds.

Then there's Blaster™ CD 6x. Experience a technologically-advanced, blistering-fast 6x CD-ROM drive. And revolutionize your multimedia experience.

Finally, complete your multimedia system with Modem Blaster™ 28.8. Wire yourself into the internet and play the hottest games modem to modem with the fastest modem available today.

So why settle for evolution alone? See your local retailer for more information and step into the multimedia revolution with Creative Labs.

CREATIVE
CREATIVE LABS, INC.
multimedia it's Creative

REVOLUTIONARY NEW PRODUCTS FOR WINDOWS 95 FROM CREATIVE LABS.

*Of course, we've made sure that the evolution is smooth by ensuring that all our products continue to run under DOS® and Windows 3.1. ©1995 Creative Technology Ltd. Sound Blaster and the Sound Blaster Logo are registered trademarks and Blaster CD, Modem Blaster, the Creative and Sound Blaster Compatibility Logos are trademarks of Creative Technology Ltd. U.S. inquiries: Fax Back Service 408-428-2389, World Wide Web (http://www.creaf.com), Creative Labs Customer Response Center 1-800-998-5227. All other trademarks are the property of their respective holders. All rights reserved.

Circle 113 on Inquiry Card.

Olivetti ink-jet printers.

Before choosing any other printer, count to ten.

1 The best of Olivetti 's know-how.

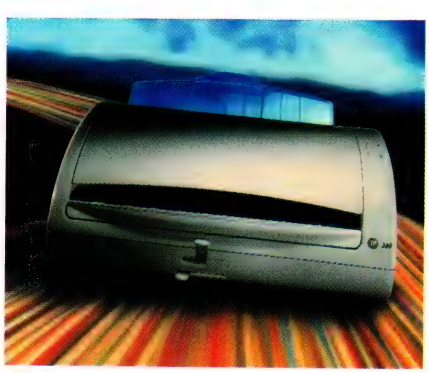
Olivetti is Europe's biggest manufacturer of ink-jet printers. Its products are the result of 20 years' experience and research in this sector and all of Olivetti's plants and production processes have received ISO 9001 total-quality certification.

2 JP 450: productivity and flexibility.

The JP 450 is the fastest printer of its kind. It prints up to 5 pages a minute and can reach a virtual resolution of 600 x 300 dpi in text mode - perfect print quality. Silent and powerful, it can be equipped with numerous options such as a 2nd sheet-feeder, a sprocket for continuous stationery or a special feeder for envelopes and transparencies, making it a highly flexible tool even for automatic mailing. And the JP 450 is already preset to give you excellent colour prints.

3 JP 360: the best at a low price.

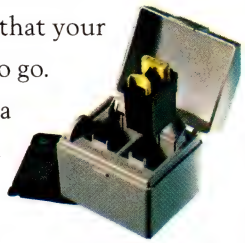
Also preset for colour printing, the JP 360 offers the best price/performance ratio. In fact, it gives you the same print quality as the JP 450 - both in black and white and in colour - using the same print heads. It can print up to 3 pages a minute and takes up a minimum of space.



4 The best colour when you need it.

The optional colour kit for the JP 450 and JP 360 opens the door to high-quality printing.

You decide when you want to use colour, knowing that your printer is ready to go.



The kit contains a manual with lots of tips on creating the best colour documents, plus the powerful Olichrome driver for hi-fi chromatics.

5 JP 50: portable technology.

The JP 50 concentrates desktop performance into 1100 g. and 30x13x6 cm. It works when and where you want it to, running either off the mains via the standard power adapter (which doubles as a battery charger), on regular or optional rechargeable batteries -

providing 80 to 140 page autonomy - or on the optional car adapter cable. Although it's the smallest and lightest portable ink-jet printer, the JP 50 offers 300 dpi resolution, prints 1.7 pages a minute and has a built-in ASF.

6 Low running cost.

All of Olivetti's ink-jet printers use a patented refill system that allows a significant cost per page reduction compared with traditional ink-jet printers. The actual print head can be reused several times - only the ink cartridge is changed. All models automatically signal when the refill is running out so that the head doesn't run dry, protecting it from possible damage. They also give you economy or draft print choices that save about 50% on ink. All this at energy consumption 20 times lower than a laser.

7 Fonts for free expression.

Olivetti ink-jet printers give you the utmost freedom of expression, thanks to their wide range of fonts - 30 resident and 25 scalable True Type fonts for Windows.

8 Total compatibility.

Every feature of the Olivetti ink-jet printers, even the most exclusive, is immediately available thanks to a range of drivers loaded on the disk that comes with the printer. Designed and certified by Olivetti, the drivers are tested and approved by the biggest international software producers to guarantee their full compatibility and optimum performance. In the package you'll find drivers for Windows and the most popular DOS programs, while those for more specific needs (such as Windows NT and OS/2) are available on request.

Technical Features			
	JP 450	JP 360	JP 50
Ink-Jet Refilling System	Yes	Yes	Yes
Color Kit	Yes	Yes	-
Max resolution (dpi)	600x300	300	300
Max speed (cps)	400	180	100
ASF capacity	150	70	15
cps in LQ mode	160	120	100
TrueType scalable fonts	25	25	25
Resident fonts	30	30	30
Page per min. (max)	5	3	1.7
Expansion slot	1	1	-

9 Ergonomic design.

In the Olivetti tradition, design is always in the forefront. The softly rounded, exclusive and attractive shapes of these printers are the result of rigorous, ergonomic research to guarantee their easy, safe and dependable use.

10 Customer care: 15,000 specialists.

Those selecting Olivetti JP printers find an international network of 5,500 Dealers and Systems Partners and 15,000 specialists to provide companies with all of the assistance, support and advice they need. This, like the others listed above, is only one of the many reasons for relying on Olivetti. And for counting to ten before choosing any other printer.

For further information, phone :
Austria (1) 816940 - Belgium (2) 2299111
Denmark (31) 201000 - Finland (0) 88741
France (1) 49067000
Germany (69) 66922755
Greece (1) 9373800 - Holland (71) 319931
Israel (3) 7516879 - Italy (167) 012587
Norway (22) 186100 - Portugal (1) 3558260
Spain (900) 370370 - Sweden (8) 59005200
Switzerland (1) 8391565
Turkey (212) 2750810 - U.K. (800) 447799.

olivetti

Circle 516 on Inquiry Card (RESELLERS: 517).

X86 PROCESSORS

Intel's Rivals Ready to Exploit P6 Weakness

Benchmarks run on an early reference system confirm that the P6 is not the best chip for running 16-bit software. AMD and Cyrix say they won't have the same problem.

BY THE BYTE STAFF

The mediocre performance of the next-generation P6 processor on Windows and 16-bit DOS code creates an opportunity that Intel's competitors are eager to exploit. At least two of those competitors, AMD and Cyrix, say their respective next-generation x86-compatible processors, the K5 and the M1, will not suffer from the P6's defects when running Windows 3.1 or Windows 95 software.

As reported in BYTE last month (see "P6 Weakness Revealed"), preliminary benchmarks run by Intel indicated the P6 performs best when running 32-bit code. Older 16-bit and current mixed 16/32-bit code (as found in Windows 3.1 and Windows 95, respectively) that makes use of segment writes, partial register operations, unaligned data accesses, and instruction-prefix bytes stymies the P6. This is because when Intel started designing the P6 about five years ago, the company thought most code running on today's desktops would be 32-bit. Thus, the P6 was not optimized for 16-bit performance. BYTE recently confirmed the P6's poky 16-bit performance by running a variety of benchmarks, including a special 16-bit version of the cross-platform BYTEmark CPU and FPU benchmarks (see the figures below).

AMD says its K5 has extra tag fields and comparators in the reorder buffer to handle partial register accesses more smoothly than the P6. Also, unlike the P6, the K5 can execute segment changes speculatively, a technique that avoids significant performance penalties.

Cyrix's M1 has special circuitry that makes its performance when handling segment-register writes, partial register updates, and instruction-prefix bytes better than that of the P6 when running 16-bit and mixed 16-/32-bit Windows code. Cyrix officials say the M1 will offer better 16-bit and equivalent 32-bit performance as the P6.

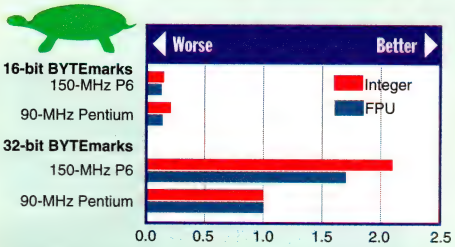
Tests performed on an early P6 reference system produced by Intel highlight the P6's 16-bit/32-bit performance gap. We ran a variety of benchmarks on a 150-MHz P6 reference system. The system had a 60-MHz I/O bus, 64 MB of two-way interleaved RAM, a Diamond Stealth Pro video card, and the P6's integrated, 256-KB secondary cache. Our tests indicate that for running 16-bit applications, you'll almost always get equal or better performance for less money if you buy a PC based on a 90-MHz or faster Pentium instead of one based on a first-generation P6 processor.

When running a 16-bit version of BYTE's cross-platform BYTEmark CPU/FPU benchmarks, our baseline 90-MHz Dell Pentium outperformed the 150-MHz P6 on all tests except the Fourier test. The reason the P6 won here is because every test except the Fourier test operates in a source/destination fashion.

With source/destination operation, the tests process a quantity of data (source) and output another quantity of data (destination). For example, the IDEA test reads a large array of text and encrypts it into a destination array.

All the source/destination-

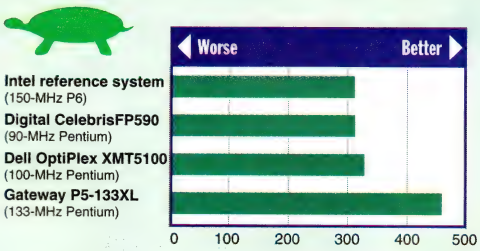
P6 Poky While Running 16-bit Software



A 90-MHz Pentium running 32-bit extended DOS in protected mode = 1.0.

BYTE's cross-platform BYTEmark CPU and FPU benchmarks confirm that a 90-MHz Pentium outperforms a 150-MHz P6-based system running 16-bit code. The performance of the P6 improves over that of the Pentium when running 32-bit code, as you would expect.

16-bit Application Performance Poor, Too



SYSmark scores are from the BAPco's SYSmark benchmark running a variety of Windows 3.1 applications.

The P6's difficulty with 16-bit code is less pronounced at the application level, but it's still noticeable. Practically any 100-MHz Pentium-based machine will outrace a 150-MHz P6-based computer when running Windows 3.1 applications.

style tests must call the segment-offset calculation routine repeatedly. On the P6, this results in a performance penalty, because that routine involves a segment-register load.

If Cyrix and AMD can deliver processors that offer better 16-bit and comparable 32-bit performance as Intel's first P6, then both companies will likely sell more chips to users who want to maintain their investment in legacy code. But the window of opportunity is small. Microsoft's release of Windows 95 should push the market toward 32-bit software. And when Intel pumps up the P6's clock speed to 200 MHz, which is expected to happen later in 1996, the P6 should outperform the Pentium no matter what software it's running.

WINDOWS 95

Coming: A Better Multimedia Platform

Windows 95 includes numerous multimedia technologies, such as 32-bit video codecs, integrated MIDI and WAV audio, and support for enhanced audio CDs. But users will have to wait for other enhancements.

The first release of Windows 95 lacks a number of 3-D- and multimedia-related technologies, including OpenGL; support for hardware-assisted, full-motion video acceleration; and the Windows 95 game subsystem, among others. The lag time between the first release of Windows 95 and the appearance of additional multimedia capabilities could range from one to several months (see the table at right).

One key element that's missing from Windows 95 is support for full-motion video acceleration. This feature is missing because Microsoft removed support for the Display Control Interface (DCI) from Windows 95 earlier this year due to stability issues, according to company officials. Version 2 of DCI, which was to have incorporated several technologies for games and video-hardware acceleration, was replaced by the Direct series of APIs and the Windows 95 game subsystem.

Since DCI is not supported in Windows 95, and final code for implementing the Direct APIs wasn't slated to ship until late September, users will have to wait at least a month before new cards from such companies as Matrox, ATI Technologies, and Number Nine Visual Technology will be able to accelerate full-motion video movies in Windows 95. "Microsoft's road map for video acceleration has been quite wobbly," says an official at one hardware-acceleration company. "However, the situation should be sorted out by this fall."

Microsoft's plans for 3-D in Windows 95 have evolved, too, as the company is rolling out two new APIs to complement OpenGL. One new 3-D API, called RealityLab, is expected to enter general beta testing in September and ship commercially in 1996.

RealityLab, which Microsoft received when it acquired London-based RenderMorphics earlier this year, is a cross-platform, high-level, real-time API. The first applications written to another API, called Direct 3-D, could ship later this fall.

David Britton, group marketing manager for Windows 95 multimedia, says RealityLab is for developers who want to write consumer, business, and some virtual-reality applications using a high-level API. Direct 3-D, meanwhile, targets a different type of developer—one "who wants to get every ounce of speed and performance from the system," Britton says. Thus, Direct 3-D should appeal to developers of high-paced action games. The target market for OpenGL, which is currently available for Windows NT 3.51 and slated to ship for Windows 95 next year, is still high-end professional CAD and modeling applications. Some vendors wonder if OpenGL will ever ship for Windows 95.

Microsoft's Britton says the company will continue to improve upon Windows 95's multimedia capabilities. "You have two waves here," he says. "The first release of Windows 95 already has a faster GDI [Graphical Device Interface], 32-bit video, and other enhancements. And then, starting in September, a whole new suite of software will come out; we'll be supercharging Windows 95."

Until that happens, however, perhaps the fairest grade to give Windows 95's multimedia support is an *I*, for incomplete.

—Dave Andrews

FUTURE WINDOWS 95 MULTIMEDIA SCHEDULE

COMPONENT	COMMENT	DUE DATE
Software MPEG playback	Will allow about 24 frame-per-second playback of CD-ROM MPEG movies on high-end Pentium-based PCs.	Undetermined.
Windows 95 Game Subsystem	Allows programs written to the Direct series of APIs (e.g., DirectDraw) to execute under Windows 95.	First version, to be distributed by independent software developers with their applications, may ship in late September. Time frame for inclusion in Windows is undetermined.
DirectDraw, DirectSound, DirectPlay, DirectInput APIs	Games and multimedia APIs that allow hardware-accelerated 2-D video, high-performance sound, networked multiuser support, and digital joysticks.	The first applications and drivers for hardware-accelerator cards could appear in late September.
Direct 3-D device driver interface	Driver interface for hardware developers that lets boards accelerate multiple 3-D APIs used by software developers.	Expect applications and drivers for hardware to begin appearing this fall.
Direct 3-D	Low-level API for software developers, especially those developing games, who want fast 3-D performance.	The first Direct 3-D applications might appear this fall.
RealityLab 3-D API	High-level, real-time 3-D API for developers writing consumer, business, and virtual-reality applications.	Expected to enter broad beta testing in September. Expect final code and the first applications in the first quarter of 1996.
OpenGL	High-end 3-D API for developers writing professional CAD, modeling, and other engineering applications.	Available now in Windows NT 3.51, but Windows 95 availability is slated for 1996.
Surround Video	A 360-degree multimedia environment (for more information, see "See You Around," May BYTE).	Undetermined.

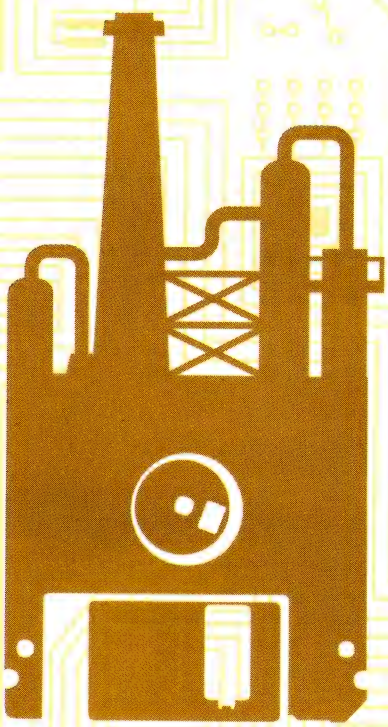
Get a Fast Start on the Automation Learning Curve!

Devoted exclusively to the computing needs of chemical engineers, Chemputers Europe II brings together leading software developers and users from around the globe. This year's conference will feature dozens of papers from key innovators in engineering software, and from pioneering chemical manufacturers and engineers testing and using the latest software.

An adjoining Demonstration Hall will feature exhibits by many of the companies participating in Chemputers Europe. There will be ample opportunities to meet with these leading vendors to obtain more information, and to "test drive" the industry's hottest new products.

The Chemputers Europe II program is broadly divided into two tracks: Process and Plant Design, and Plant Operations and Management. Within these tracks, the following sessions and papers have been scheduled:

Chemputers



PROCESS AND PLANT DESIGN
(includes process simulation, estimating, CAD and design optimization)

Detailed Design, Estimating and Scheduling Software
K. Adamson, Product Manager, EA Systems Inc. and R. Steinberger, Director, Icarus Corp. USA

Process Simulation in Chemistry and Environmental Technology
W. Schmidt, Chemstations Europe, Germany

The Plant Data Life Cycle
G. Stiksma, Project Automation Manager, Fluor Daniel, Netherlands, and Frank Joop, PDS Manager, Intergraph, USA

Dynamic collaboration: The next decade of process computing
John Voeller, Black & Veatch, USA

The design of Steam Reformers using Computational Fluid Dynamics
F.P. Waterrus, C. van Leeuwen, Kinetics Technology International B.V., The Netherlands

CFD studies on the influence of impeller spacings on Flow Fields and Mixing Times in Stirred Vessels
R.S.H. van der Geest, Research Scientist, Unilever BV, The Netherlands

PLANT OPERATIONS AND MANAGEMENT
(includes process control, manufacturing execution systems, advanced control, engineering document management, training, maintenance and environmental monitoring)

A structured approach to Automating Complex Batch Processes
A. Pampel, AFP Consulting; J. Vreysen, System Manager, Elsag Bailey Process Automation, Belgium

Large-scale Process Simulation-The System Architecture Requirements
P. Van Santen and J. van Loon, Marketing Manager, Setpoint BV, The Netherlands

Online Optimization of Process Operations
S. Mullick, Research Scientist, Simulation Sciences, USA

Standardized Plant Life Cycle Data
Ben Maasman, Akzo Nobel Engineering, Netherlands

Application of multivariable control to MTBE production
Doug Robertson, Staff Engineer, DMC Corp., USA

A new approach to online optimization
Peter Winter, European Director, Sacda UK

Computerized process management boosts industry profits
C.W. Taylor, Technical Manager, Marex Technology, England

Manufacturing Execution Systems—Requirements and New Developments (Capisce)
T. Allweyer, Research Scientist, Institute for Information Systems, W. Saarland

Manufacturing Execution Systems: A Corporate Initiative with a Supplier's Collaboration
Phil Hannay, Cargill Inc., USA, George Turanchik, GSE Process Solutions Belgium NV, Belgium

Plantwide information systems: Application in a mineral oil treatment plant
J.E. Hille, Eurostill B.V., The Netherlands

Manufacturing Execution Systems in the production of chemicals
B. Adams, Vice Pres., Incode Europe, England

PDXI Progress report
M. Dalton, Eastman Chemical Co., USA; Stewart Goldfarb, Simulation Sciences, USA (Chairman and Vice-Chairman of PDXI Technical Committee)

RELIEF: A computer package for Emergency Pressure Relief Studies
J.S. Duffield, EU Joint Research Center, Italy

Advanced Training Simulation for Sulfur Recovery Units
A.N.S. Mak, Comprimo BV; C. Geen, Sacda UK Ltd.

Multi-purpose dynamic simulation-Making the most of simulation investments
Richard Bailey, BP Intl., UK; Mark Matzopoulous, Cape Software Ltd., UK

EGIS: A contribution to the standardization of environmental software and databases for the chemical process industries
K. Kaiser, J. Schwab, Technidata GmbH, Germany

PLUS: *The Internet for Chemical Engineers: A hands-on session of demonstrations and talks on what is happening in this fast-moving new medium*

PLUS: *Panel Discussions*
Each track will conclude with a panel discussion of leading developers in process design and plant operations. Discussion topics include:

DYNAMICS OF PLANT CONTROL AND SIMULATION

INTEGRATING DESIGNS AND DATA IN THE PLANT LIFE CYCLE

PROGRAM SUBJECT TO CHANGE. ADDITIONAL PAPERS ARE NOW BEING SCHEDULED!

Hosted Meetings

A number of related meetings are being held in conjunction with Chemputers Europe II. These meetings will provide additional opportunities for exploring specific topics in more detail. The current lineup:

ECOS at Chemputers
Simulation Sciences' European Conference on Open Simulation. Free to all Chemputers attendees, ECOS features presentations on the implementation of Microsoft and other standards in PROvision. Oct. 12.

PlantSTEP European Industry Review Board
Emerging standards for Electronic Data Interchange, focusing specifically on the activities of STEP consortium. Free to Chemputers atendees. Oct. 10.

European Batch Forum (EBF)
EBF's Annual Fall Meeting will focus on the recently completed SP88 Part I standard for batch control, and will look at the implementation of both Part I&II of this standard. EBF attendees can participate in the Chemputers Conference at no extra charge. Oct. 11-12.

Europe II

October 10—12, 1995 Noordwijk, The Netherlands

Registration Form

Chemputers Europe II Conference and Exhibition

Liebigstrasse 19
D 60323 Frankfurt am Main, Germany
Tel: 49.69.7140.7137
Fax: 49.69.7140.7147

1221 Avenue of the Americas
New York, NY 10020
Tel: (800) 845.5056
Fax: (212) 512.6111

Registration fee: $350 (NGL 570). This includes two days of technical sessions, plus the PlantSTEP meeting on Oct. 10, day/evening hours at the demo hall, conference materials, continental breakfast, lunch and a reception hosted by Chemical Engineering.

❑ Yes! I would like to attend Chemputers Europe II
❑ Enclosed is a check for $/NGL _____ payable to Chemical Engineering
❑ Charge my credit card: ❑ VISA ❑ AMERICAN EXPRESS ❑ MasterCard

Name _____

Title _____

Company _____

Address _____

Postal Code/City _____

Country _____

Phone _____ Fax _____

Cardholder Name _____

Card Number _____ Exp. date. _____

Signature _____

HYPROTECH

SIMSCI SIMULATION SCIENCES INC.

EUROPEAN BATCH FORUM

PlantSTEP

Chemical Engineering
A Division of The McGraw-Hill Companies

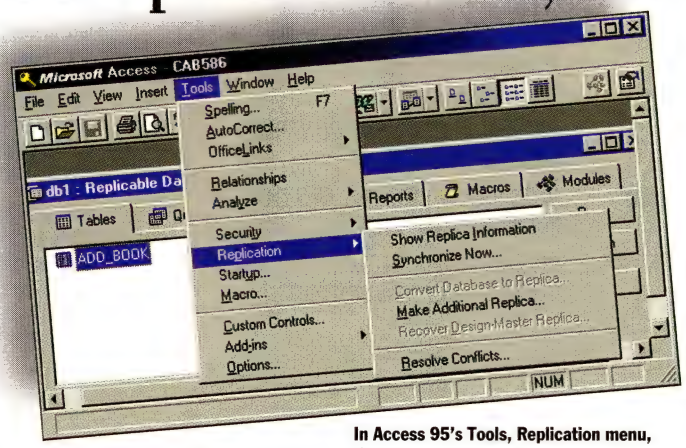
DATABASE TRENDS

New Replication Options in Access, Oracle, and Notes

The new 32-bit version of Microsoft's Access for Windows 95 database, which is slated to ship this fall, offers a host of new features. But one that should especially appeal to developers supporting remote workers is replication. Made popular by Lotus Notes and introduced for enterprise databases, such as Oracle 7, replication allows Access 95 users to work remotely with a copy of the master database and later incorporate all their changes into the master database.

Based on use of a beta version of Access 95, the easiest way to use the database's replication is through the Windows 95 Briefcase. Making a database replica is as easy as dragging and dropping a database file from a server into the Briefcase of a notebook PC that's docked to your network.

Because Windows NT 3.51 does not have the Briefcase interface, users of that OS (as well as Windows 95 users) can control Access replication in two ways: by using the Tools, Replication menu, which provides commands for controlling replication, or by using Visual Basic for Applications, which replaces the Access Basic programming language used in older versions of Access.



In Access 95's Tools, Replication menu, the items in black-on-gray are for managing replicas after a database is converted to a design-master replica. The options in gray list selections for converting a database to a design-master replica and recovering from a faulty design-master replica.

Dropping a database file into the Briefcase of a connected portable computer initially creates a regular replica and a design-master replica. The regular replica is used for updating data changes. Database developers use the design-master replica to propagate database-design changes to other replicas.

Access 95 offers replication management tools and automatic conflict resolution. But these tools don't offer quite the level of granularity that other programs, such as Lotus's (Cambridge, MA) Notes 4.0 and an upcoming version of Personal Oracle 7 from Oracle (Redwood Shores, CA), do.

Conflict resolution in a replication is the process of reconciling changes to two replicas that are inconsistent. If, for example, in one replica a customer's Bill To address changes, but in another replica the Ship To address of the same record changes, the two records conflict when they're synchronized at the record level.

Access's approach is to assign a "winner" based on which record has changed most often. If both have changed equally often, Access picks a winner randomly. This is in contrast to Personal Oracle 7 for Windows 95, slated to ship this fall, which will be able to take advantage of 10 preprogrammed rules for replication-conflict resolution that are included in Enterprise Oracle. Enterprise Oracle also enables the database developer to write custom conflict-resolution rules.

Unlike the previous version of Personal Oracle 7, which only let you replicate with a server in publish-and-subscribe (aka read-only) mode, the new version will support full symmetric replication to let it bidirectionally replicate with the large, mission-critical databases typically developed using the Enterprise Oracle database management system. Access 95 will not directly replicate with Microsoft's SQL Server database; however, officials at Microsoft say that capability might be added to a future version of Access.

Replication Manager, which will be released with the Access Developer's Toolkit, adds functionality and simplifies management. This Access component permits the scheduling of replication for particular times, such as 3:00 a.m., and the setting of synchronization rules for the sequence of replication among replicas. It also provides a "dropbox," a network location for holding replica updates. When replicas become connected to the network, they can update themselves with the dropbox contents.

But neither Oracle nor Microsoft supports field-level replication, which is promised for Notes 4.0, the Lotus groupware platform that's now slated for availability in the fourth quarter of this year. Field-level replication accelerates synchronization by reducing the amount of data that's passed in a replication.

For instance, if one field changes in a record (which is actually a document in Notes), then, instead of the whole document being passed in the replication, just a single field is passed. Field-level replication's increased efficiency bodes well for administrators who manage worldwide Notes networks.

Desktop users will have a rich array of replication options available in the fourth quarter of this year. Access 95 provides this functionality to a whole class of department-level developers. Personal Oracle tightly integrates with Enterprise Oracle to deliver some of the rich functionality of its flagship product. Lotus will reduce the time needed to replicate databases with Notes 4 when it rolls out field-level replication. —Rick Dobson

ACCESS 95

GOOD FOR:

- Letting mobile workers periodically synchronize their remote databases with the home-office version.
- Letting small businesses synchronize database replicas across a few offices.
- Database administrators who want to balance the load on a database by directing users to replicas.
- Developers who want to distribute design updates through Access replication.
- Database backup (only changes are replicated).

BUT NOT FOR:

- Replicating Access 95 data directly with Microsoft's SQL Server.

Watcom C/C++

The High-Performance, Multi-Platform Development System

New! Version 10.5
Now with Windows®95 Support & Visual Programmer by Blue Sky Software

Watcom C/C++ accelerates development of high-performance, multi-platform 16 and 32 bit applications. The integrated development environment simplifies application development and makes it easy to exploit the power of Watcom C/C++. In a single package, Watcom C/C++ provides a comprehensive development environment with the tools, SDKs and libraries you need to create powerful 16 and 32 bit applications for popular PC platforms.

Leverage Your Time and Code Investment

Watcom C/C++ supports a wide range of host and target platforms including Windows®95*. Reliable, high-performance code generation and consistent C and C++ language implementation are delivered across all supported platforms, making it easy to develop applications for several targets from a single source code base. For example, C++ templates and exception handling are provided on all supported platforms including 16-bit Windows.

Host Platforms: Windows 95, Windows NT, Windows 3.x, OS/2 Warp, OS/2 2.x, DOS

Target Platforms: Windows 95, Windows NT, Windows 3.x, Win32s, OS/2 Warp, OS/2 2.x, Extended DOS, Novell NLM, OS/2 1.x, DOS

Accelerate Your Windows Development

For rapid 16 and 32 bit Windows development, Watcom C/C++ includes the Microsoft Foundation Class (MFC) libraries and Visual Programmer (VP) by Blue Sky Software. VP is a fast MFC code generator for quick, easy and intuitive development of Windows applications. With VP, application user interfaces are designed visually using point-and-click interaction. Functional preview mode allows for quick testing of the user interface.

High Performance

Watcom's advanced compiler technology generates fast, tight code, optimizing your application's performance. Superscalar optimization strategy uses "riscification" and instruction scheduling to deliver optimum performance on 486 and Pentium processors.

"(Watcom C/C++) delivered the fastest executables we saw in this roundup."
PC Magazine, April 11, 1995.

PC MAGAZINE EDITORS' CHOICE
April 11, 1995
Watcom C/C++ 10.0

Watcom C/C++ 10.5: **$350**
Watcom C/C++ 10.5 Competitive Upgrade: **$199**

Find it at CompUSA and Egghead or call 1-800-265-4555

Watcom
A Powersoft Company

Watcom International Corp. 415 Phillip Street, Waterloo, Ontario, Canada N2L 3X2 Telephone: (519) 886-3700 FAX: (519) 747-4971 Watcom Europe United Kingdom, Phone: +44 1494 555599 Fax: +44 1494 555595
All prices in US dollars. Price does not include freight and taxes where applicable. Authorized dealers may sell for less. Watcom and the Lightning Device are trademarks of Watcom International Corp. Windows is a registered trademark of Microsoft in the U.S. and other countries. BLUE SKY SOFTWARE and VISUAL PROGRAMMER are trademarks or registered trademarks owned by Blue Sky Software Corporation. Other trademarks are the properties of their respective owners. ©Copyright 1995 Watcom International Corp. Reprinted from PC Magazine, April 11, 1995. Copyright © Ziff-Davis Publishing Company.
*Get started with Windows 95 development using Watcom C/C++ and the pre-release version of Windows 95. All registered Watcom C/C++ 10.5 developers are entitled to receive a free version 10.6 upgrade, after Windows 95 is released.

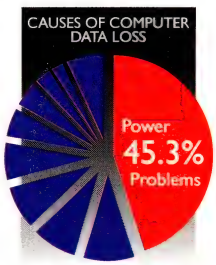
Circle 108 on Inquiry Card.

New Back-UPS®: $119 blackouts, brownouts

MICROSOFT WINDOWS COMPATIBLE

Just don't have the time for power problems on your PC? Don't worry. They'll always make the time for you. It's not if a power problem will occur, but when. Due to household appliances, poor wiring, bad weather or even other office equipment, power problems are as inevitable as death and taxes. You can't run, but you can hide, behind APC protection.

That's why we've just introduced new models in our award-winning Back-UPS line, now delivering reliable protection for just $119.



Source: Contingency Planning

Source: Bell Laboratories

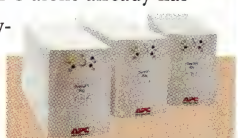
IN THE NEXT THREE MONTHS, MORE THAN 30,000,000 PCs WILL BE HIT BY POWER PROBLEMS...

Who needs power protection? If you use a computer, you do. A study in a recent *PCWeek* showed that the largest single cause of data loss is bad power, accounting for almost as much data loss as all other causes combined. Every PC plugged into an outlet is vulnerable. In fact, you have better odds of winning the lottery than of escaping the sting of power problems. One study found a typical PC is hit over 100 times a month, causing keyboard lockups, hard drive damage, and worse.

Simply put, if power problems are the least of your troubles, you've got one chance to keep it that way. You insure your car and home with the best policy you can afford. It just doesn't make sense to leave your PC (which is at far greater statistical risk) vulnerable to loss or damage.

WHY A $119 APC UPS COSTS LESS THAN A $9.99 "SURGE PROTECTOR"...

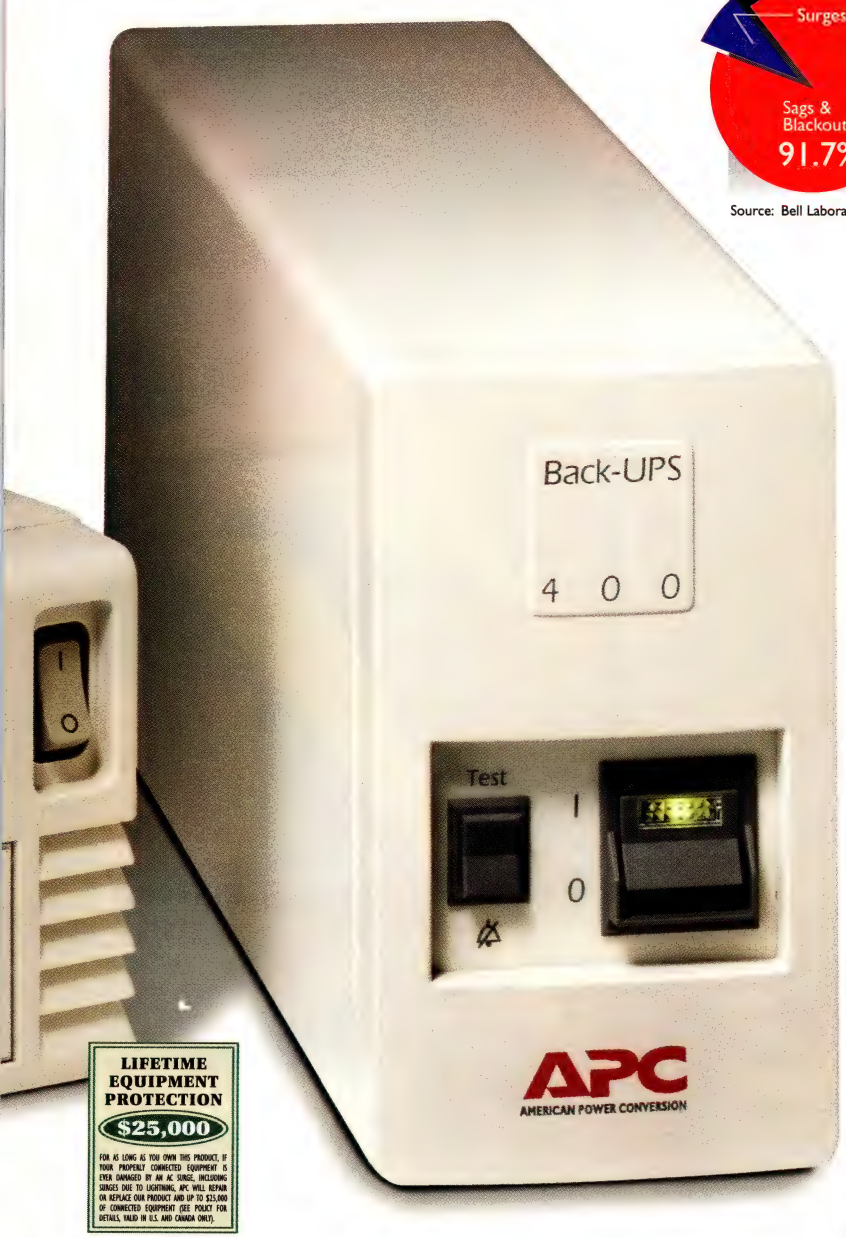
Contrary to most people's belief, a PC alone already has more protection built into it than a low-end "surge suppressor," which is usually nothing more than a well-packaged extension cord. In other words, going without any protection is just as good as underspending on one of the most important PC decisions you'll make.



For extended brownout protection for advanced PC workstations call about APC's New Back-UPS Pro!

And since sags and blackouts represent more than 90% of power problems likely to hit your computer, even quality, high-performance surge suppressors are literally powerless to protect you from data loss.

That's why you need instantaneous battery backup power from an APC Uninterruptible Power Supply to prevent



PC World Top 20 Upgrade

"Don't take chances. Get the ultimate protection... from APC." --PCWorld

"★★★★ Back-UPS should be standard on every desktop... effective, affordable, designed to last..." --PC Computing

"A UPS can pay for itself the first time it saves your data." --MacUser

PC MAGAZINE UK EDITORS' CHOICE

"The clear winner in price performance... it's unbeatable..." --PC Magazine UK

© 1995 APC, 132 Fairgrounds Rd. W. Kingston, RI 02893. Back-UPS & PowerChute, are trademarks of APC. Other trademarks are property of their owners. Specs subject to change without notice.

rotection against
nd other trials by fire

More than 3,000,000 satisfied customers count on APC reliability that goes above and beyond the call of duty

After a raging fire which took 18 trucks to subdue, Michael Benolkin, director of the Systems Division at Correa Enterprises, Inc. didn't expect much. "While rummaging through the ashes, we heard something beeping. Our four APC units were still in action, while two UPSes from another brand were history. We're still using these same APC units at our new office location - they still work like a charm! We're impressed with the ruggedness, reliability, and product support offered by APC."

Trial by Fire

Brian Krause, Network Manager for Goodyear Airship Operations, knows how critical APC protection can be." The night of the All-star game a tornado came through our blimp hanger and took out our roof. Our airships demand absolute communication so I protect our local and remote servers with the most reliable protection I can find: APC. APC's PowerChute software shut our server down in an orderly way... closed out all files nice and neatly. When we reconnected, everything came back up perfectly, without a hitch."

Trial by Air

Doug Welch learns his reliability lessons well: "While still a Computer Science student, I was at home preparing a large spreadsheet for a final project when Anchorage experienced an all too common 5+ Richter earthquake. If not for my Back-UPS 400 it would have been back to square one! I'm now the Network Systems Manager at Charter College, in charge of three networks. I learned my UPS lesson well back in my student days. I've never been disappointed with APC and the product has had quite a work out."

Trial by Earth

Faced with a water main break, Mark Conley, Regional Manager of Novell's remote sales office in Detroit was amazed at APC's reliability. "The APC unit was sitting in an inch and a half of water, working just fine, as though nothing was unusual and we lost no data to this disaster. We've used APC here now for at least four years - more than a dozen units are all around the office, and we're well satisfied, so we were even more impressed to learn that the units are amphibious!"

Trial by Water

Back-UPS Award Winning FEATURES

- ►Unmatched surge/lightning protection for maximum hardware safety
- ►Site diagnostics automatically spot missing ground and reversed polarity
- ►LAN signaling allows simple shutdown with interface kits for automatic data protection (400 and above)
- ►User replaceable, hot swappable batteries insure uptime safe disposal. Batteries will last 3-5 years under normal use.
- ►$25,000 lifetime Equipment Protection
- ►10 minute runtime with specified applications. For longer runtimes choose next largest unit.

Model	Application	Sugg.List
200 **NEW**	"Green" PCs	$119
280 **NEW**	LAN Nodes	$139
400	Desktop 486/386 systems	$199
450	Tower 486/386 systems	$254
600	CAD/CAM workstations	$359
900	Longer runtime	$529
1250	Multiple systems	$689

keyboard lockups, data loss, and crashes. With an APC UPS, you get six times the protection of a high-end surge protector for little more than twice the price. And $119 is much less expensive than false peace of mind. APC UPSs carry up to a $25,000 lifetime guarantee against surge damage to your properly connected equipment, and are available to suit any application, from network servers and PCs, to fax and satellite systems.

PROTECT YOURSELF OR KICK YOURSELF...

It's been said that there are two types of computer users: those who have lost data, and those who are about to. Prevent the single largest cause of computer problems and join a fast-growing third category: those who protect their PC's with the most reliable protection they can buy: APC UPSes. So ask for APC at your favorite reseller. At just $119 an APC UPS is serious protection no serious computer user should be without.

Visit APC's NEW PowerPage™ on the Internet

www.apcc.com

APC has won more awards for reliability than all other UPS vendors combined...

LAN TIMES READERS CHOICE 1994 · Reseller News Editors' Choice · VISION AWARDS BEST NEW PRODUCTS 1993 Reseller News · Windows Mag. Readers' Choice

APC®

AMERICAN POWER CONVERSION

Call 800-800-4APC

Tel: (401)789-5735
Fax: (401)788-2797
Compuserve: GO APCSUPPORT
Internet: apctech@apcc.com

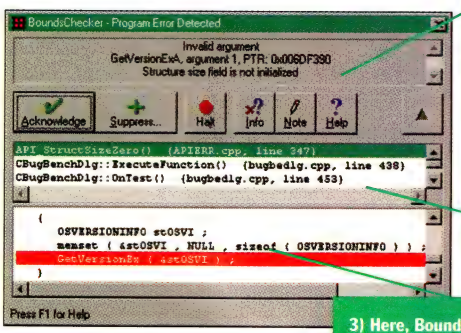
please reference Dept. A2

France: (+33)1.64.62.59.00 Germany: (+49)89 958 23-5 UK: (+44) 753 511022 Ireland: (+35)391 702000 Latin America: (+1)401.789.5735 Japan: (+83)5295 1988

Circle 63 on Inquiry Card.

PROGRAMMING TOOLS

Run-Time Error Checking Comes to Compilers



1) Nu-Mega's Bounds Checker Professional indicates an invalid argument, the cause of which was an uninitialized structure-size field.

2) The middle pane shows the call stack.

3) Here, Bounds Checker Professional displays the source code, with the offending code highlighted.

The familiar programmer's grind—compile, run, debug, and repeat as necessary—will have another major step added to it if proponents of run-time error checking have their way. Borland, Microsoft, and Nu-Mega Technologies are making strong efforts to integrate this reliability-enhancing technology more deeply into the programming cycle by hooking run-time error checkers directly into the Borland C++ and Microsoft Visual C++ integrated development environments (IDEs).

Tools vendors have always supplied programmers with expressive languages, such as C, and prewritten code in programming libraries, which lets developers write more powerful applications for end users. Meanwhile, in today's highly competitive market, programmers must race to add new features to their programs. However, the difficulty of tracking memory and resource allocation grows with the use of higher-level APIs and language extensions. The result of these two trends is often more features—but also more bugs—in applications.

"Top quality is not the winning market feature in applications today," says Jim Moskun, chief technology officer at Nu-Mega (Nashua, NH, (603) 889-2386). Nu-Mega hopes to help reverse that trend with its Bounds Checker Professional, slated for September announcement (price at press time was undetermined).

The company's current Bounds Checker for Windows, which automatically flags memory and resource leaks, monitors illegal address references, and validates Windows and C-library APIs, established the Windows run-time error-detection category of tools. But Bounds Checker, according to Nu-Mega president Frank Grossman, is used primarily in the quality-assurance stage of program testing, in which a programmer often receives an error report months after writing an errant module.

Bounds Checker Professional, in contrast, is designed for daily use, allowing programmers to catch errors while the code is still fresh in their minds. "We want programmers to check early and check often," says Grossman. The program integrates directly into the Visual C++ environment on the toolbar, making it as easy to error-check a program as it is to merely run it. The program also enables programmers to do such things as ignore validation flags or errors by module or by function, which allows team members to check only the files that they've modified, or ignore a known bug in application framework code.

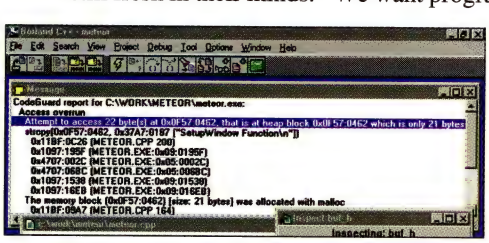
Bounds Checker Professional's ability to let project managers establish libraries of acceptable errors lets a manager give each programmer a readily definable mission: Make every module run cleanly through error checking. Nu-Mega's error-detection software will run with all Visual C++ environments.

Microsoft (Redmond, WA, (206) 882-8080) is also making run-time error detection a more integral part of its upcoming Visual C++ 4.0 by including C debugging libraries. These libraries should help programmers identify problems that occur at the interface between the user and Microsoft-supplied code.

Borland (Scotts Valley, CA, (408) 431-1000) is also releasing new error-checking programs. Although Bounds Checker Professional works with Borland and Symantec compilers, it is tightly bound only to Microsoft's Visual C++ IDE. Borland's new CodeGuard program brings a similar level of error-checking integration to the Borland camp.

CodeGuard hooks into the Borland C++ 4.5 IDE, detecting memory and resource errors and validating API parameters in a one-step process for programmers writing 16-bit Windows programs. CodeGuard isn't quite as expert as Bounds Checker Professional is at handling tricky API problems, but Borland officials say they will continue to add capabilities to their program.

As tool vendors put run-time error detection into the hands of every programmer, developers and end users alike will benefit. Developers will become more efficient and effective, while users will get better, more reliable programs. **—Steve Apiki**



CodeGuard hooks into the Borland C++ 4.5 IDE, detecting memory and resource errors and validating API parameters in a one-step process for programmers writing 16-bit Windows programs.

Whatever Happened to . . .

OS/2 for PowerPC?
(see "OS/2 on the PowerPC Slated for This Year," June 1994 BYTE)

The official word from IBM is that OS/2 for the PowerPC is expected to enter general beta testing this fall and to be released by the end of the year. IBM has shown preliminary versions of OS/2 running atop PowerPC hardware at several industry trade shows over the past several months, but performance on these demonstration machines was poky.

The delay of OS/2 for the PowerPC means that IBM's new PowerPC-based Personal Computer Power and ThinkPad Power series of computers and notebooks can run only Windows NT or AIX. Meanwhile, Canon (Costa Mesa, CA) is positioning its new PowerPC-based Power Workstation line of systems and notebooks as "PowerPC Windows NT solutions." **—D. A.**

Silicon Graphics
Computer Systems

There's only one thing about our computer that's not in keeping with industry standards.

The performance.

Indy Modeler. The affordable CAD/CAM/CAE solution.

There's one computer in the market that runs all major CAD/CAM/CAE software, supports network standards like TCP/IP, Netware™ and NFS™, comes standard with SoftWindows™ and innovative workgroup collaboration software, and gives you incredibly powerful 3D modeling performance.

Indy Modeler.™

So it's hardly surprising that it won the AIM Benchmark award for best price/performance in its class.

Indy Modeler runs all major software including Pro/ENGINEER,™ Pro/JR,™ AutoCAD® R13, SDRC-I-DEAS Master Modeler,™ Matra Datavision-Prelude and MicroStation Modeler.™

For more information, in Germany call 89 46 10 80, in France call 134 888 000, in the UK call (toll free) 0800 440 440. From outside these countries, please call 22 99 99 260, or visit us at our World Wide Web site, http://www.sgi.com/Works.

see what's possible

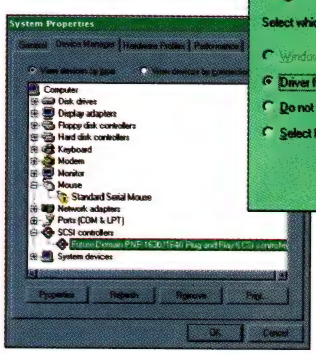
© 1995 Silicon Graphics, Inc. All rights reserved. Silicon Graphics is a registered trademark, and Indy, Indy Modeler and see what's possible, are trademarks, of Silicon Graphics, Inc. Netware is a trademark of Novell. NFS is a trademark of Sun Microsystems. SoftWindows is a trademark of Insignia. Pro/ENGINEER and Pro/JR are trademarks of Parametric Technology Corporation. AutoCAD is a registered trademark of Autodesk, Inc. I-DEAS Master Modeler is a trademark of SDRC. Microstation Modeler is a trademark of Bentley Systems, Inc. Screen image courtesy of Intergraph Corp.

WINDOWS 95 PLUG AND PLAY

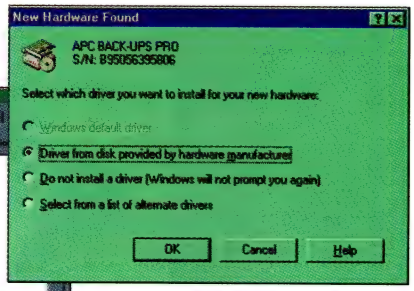
We Plugged, but They Didn't All Play

Windows 95 brings together a variety of components to make installing new peripherals in a PC as easy as upgrading a Mac. But tests of several new Plug and Play (PnP) devices show that unless you have all the required pieces in your PC, you can expect to do a lot of work before you get to play.

Various pieces of the PnP puzzle were available prior to the release of Windows 95 (see "Transforming the PC: Plug and Play" in the September 1994 BYTE). But the piece that pulls it all together is a PnP OS. Thanks to the arrival of Windows 95, the promise of PnP on the PC has at last become a reality—sometimes.



When we installed a Future Domain SCSI controller, the PC recognized the device automatically. Even better, the PC performed properly after we removed the SCSI controller.



When we installed APC's UPS, Windows 95 detected the new device and presented this dialog box, which prompted us to install software from a floppy disk. If we had loaded the Windows 95 installation CD into the PC's CD-ROM drive, this dialog box would not have appeared; instead, the APC software would have installed directly from the Windows 95 CD.

BYTE tested several new PnP devices, legacy SCSI and network adapters, and a new uninterruptible power supply (UPS). To evaluate how the new devices will fare in the typical office containing older PCs, we tested them on legacy computers that don't have a PnP BIOS. Our tests show that if you have a variety of legacy equipment, you may need to pray before you play.

One peripheral that we tested, the American Power Conversion BackUPS Pro 650 UPS from APC (West Kingston, RI, (401) 789-5735), highlighted the benefits of PnP when it works, as well as the frustrations that you can expect when it doesn't. When PnP worked, configuring the BackUPS Pro was a breeze. We plugged in the AC cord, connected the serial cable to our PC, turned on the UPS, and rebooted the PC. Windows 95 detected the presence of the new UPS and presented a dialog box (see the screen above).

If we had loaded the Windows 95 installation CD into the PC's CD-ROM drive, the process would have been even smoother. The dialog box would not have appeared; instead, the APC software would have been installed directly from the Windows 95 CD. Regardless, once the APC software was installed, we didn't have to tell the software which serial port to use, set the data transfer rate, or perform any of the other operations that adding UPSes has traditionally required.

This magic involves a handshake between Windows 95 and the APC UPS. During boot-up, Windows 95 sends out a query on the serial port. The APC UPS responds with a message that includes the product's name and serial number. If Windows 95 doesn't recognize the device from its hardware list, it then begins the installation process described above.

The APC UPS/Windows 95 combination worked fine on an old no-name clone PC, but it didn't work on a much-newer Zeos Pantera. Neither system had a PnP BIOS, but both should have been able to complete the auto-detection and automatic software installation. Nothing we tried could get the Zeos/Windows 95/APC combination to work automatically. We finally resorted to a manual installation, using the Add Hardware applet in the Control Panel.

Adding a UPS isn't too difficult a process, since it's an external peripheral. Where PnP is really supposed to help is when you add an internal card, as well as after you've installed it; you can reconfigure PnP cards without having to reopen your computer.

To test this capability, we first tried an EtherEZ 10Base-T network adapter from Standard Microsystems Corp. (SMC, Hauppauge, NY, (800) 762-4968). This time we installed the Windows 95 CD before putting in the card. When we rebooted, the PC detected the new adapter and installed the software from the CD without any additional intervention on our part.

But unfortunately, the computer had previously been using a non-PnP NE2000-compatible adapter. Because this older adapter wasn't a PnP device, Windows 95 still loaded its driver, even though the card was no longer installed. The Windows 95 Device Manager indicated an error in using the NE2000-compatible device, but the Microsoft Networking log-in did not; it simply said that no domains were available.

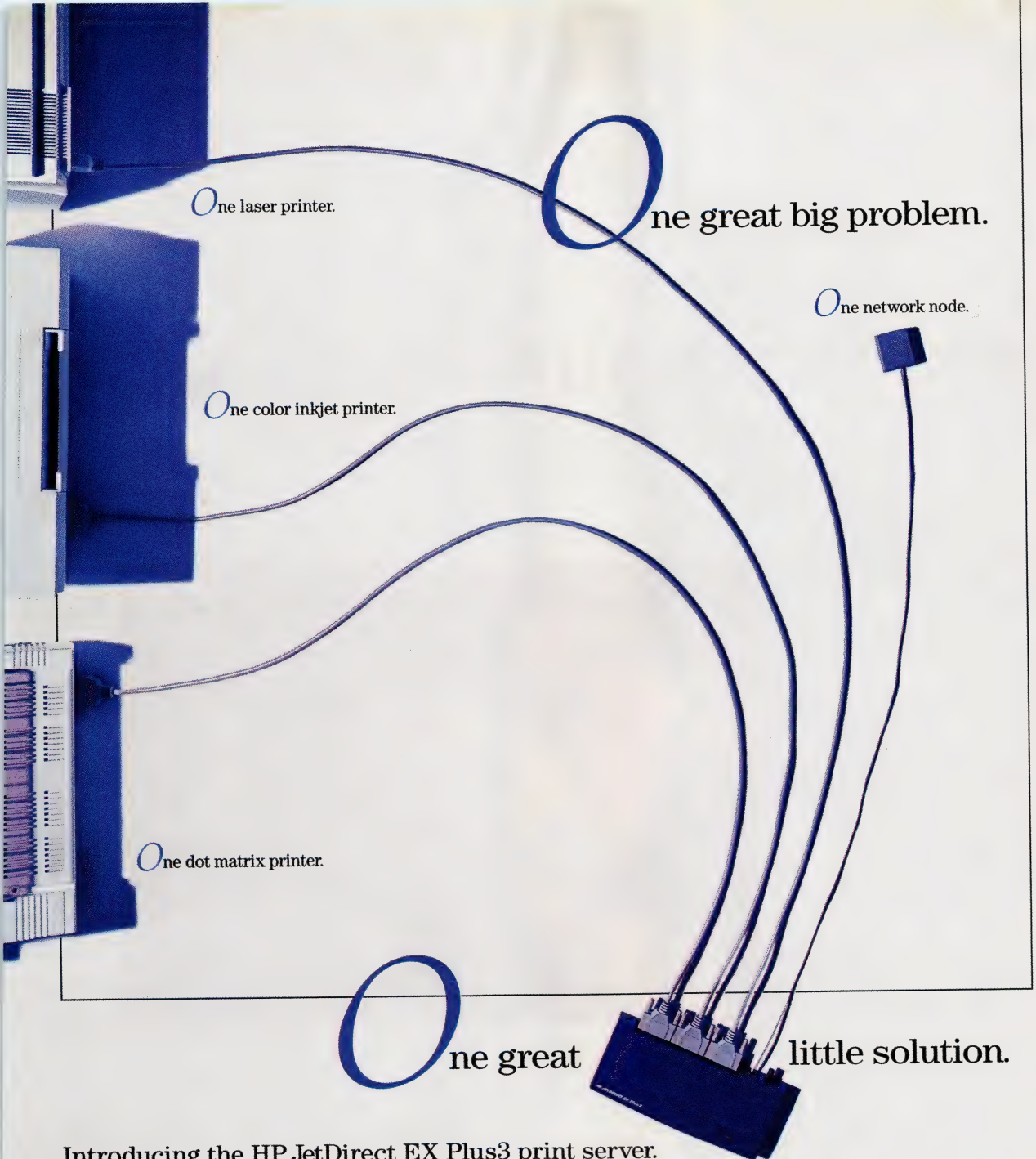
From the Device Manager, it was a relatively simple matter to remove the NE2000 device. Even so, after we plugged in the PnP network adapter, it took an awful lot of configuring and rebooting before we got it to work.

Our only true success story was with the Future Domain (Irvine, CA, (714) 253-0400) PNP-1640 SCSI controller (see the screen at left). The PC initially detected the new card much as it did the APC UPS and the SMC EtherEZ. But even better, whenever we removed the Future Domain card and then rebooted the PC, the device driver did not load, and no entry appeared in the Device Manager.

Note that our mouse, which was not a PnP device, showed an error because it was not plugged into the serial port. If the mouse had been PnP compatible, Windows 95 wouldn't have loaded the driver at all.

PnP promises a better future for those who want to upgrade their PCs. But as our experience illustrates, PnP works best when everything—the BIOS, the OS, all the attached devices, and your applications—are PnP compatible. This is welcome news for vendors who want to sell new PnP products, but not such great news for system administrators. For those without a PnP BIOS, the combination of Windows 95 and PnP devices still brings benefits. But adding new devices is still not without some pain, and the experience is rarely as simple as plugging something in and turning it on.

—Rex Baldazo



Novell Labs Tested & Approved

PC MAGAZINE EDITORS' CHOICE

LAN TIMES READERS' CHOICE 1995

Introducing the HP JetDirect EX Plus3 print server.

Now you can connect up to three parallel printers to a single network node.

Your office has all kinds of printers, and all kinds of printer configurations, all of which can change daily. And it's your job to hook them all up to the network. With a limited number of nodes, that can be a big problem.

Fortunately, there's an easy way out–and in. The new HP JetDirect EX Plus3 print server lets you connect up to three printers to the network, using only one LAN connection. Best of all, it works with any parallel printer, and supports virtually every network protocol and NOS out there.

For fast faxed information, call 1-800-964-1066.* You'll discover that for every problem, there's a solution. At least when it comes to network printing.

NOS Compatibility: Novell NetWare; Microsoft® Windows™ 95, Windows NT, Windows for Workgroups, LAN Manager; IBM LAN Server; UNIX®: HP-UX, SunOS, Solaris, IBM AIX, SCO UNIX, lpd; Apple Ethertalk

Management Support: HP JetAdmin print management software enables consistent installation and management of any HP JetDirect connected printer on the network; supports SNMP-based network management software

- Flash memory for easy upgrades
- Multiple protocols with automatic switching
- Three high-performance IEEE 1284 ports
- 3-year return to HP warranty
- HP JetDirect EX and EX Plus3 print servers support all parallel printers
- HP JetDirect cards support HP printers with I/O slots

HEWLETT® PACKARD

Specifications for HP JetDirect EX Plus3. Award logos apply to HP JetDirect EX. *In Canada, call 1-800-387-3867, Dept. 239. Microsoft is a U.S. registered trademark and Windows is a U.S. trademark of Microsoft Corporation. UNIX is a registered trademark in the United States and other countries, licensed exclusively through X/Open Company Limited. ©1995 Hewlett-Packard Company RND016

EXPAND YOUR HORIZONS

Data Communications
ASIA-PACIFIC

NETWORK WITH ASIA It's no secret that the Asia-Pacific market is about to reach critical mass. Multinational companies, large end-user organizations, PTTs, VARs, and distributors throughout the region are in a hurry to find new technology. They've already seen what enterprise networks and applications have done for their counterparts in the U.S. and Europe. And many don't have a legacy infrastructure to protect. ▼ Now there's a simple, cost-effective way to get your product message to the industry's top networking talent in the more than 20 national markets that make up this hotbed of opportunity—*Data Communications Asia-Pacific*. **WE'LL TAKE YOU THERE** Since 1972, *Data Communications* magazine has been making a name for itself in the Asia-Pacific region, establishing its reputation as required reading among technical networking professionals from Australia to New Zealand and Bangladesh to Thailand. ▼ Now we've expanded our coverage of this critical marketplace with *Data Communications Asia-Pacific*. Each month, this regularly scheduled editorial package emphasizes regional products and services and investigates national regulatory environments. **TUNE INTO THE CHANNEL** Doing business in Asia means reaching vendors and customers through distribution channels. And *Data Communications Asia-Pacific* can put you right in the pipeline. A full 25 percent of our Asia-Pacific readers work at VARs, distributors, systems integrators, and outsourcers. **TRAVEL FIRST CLASS** *Data Communications Asia-Pacific* delivers all the award-winning editorial included in our regular issues. It's written and published in English, the language that Asian networkers use to discuss technology and talk to their suppliers. And it's headed up by To Chee Eng, our full-time Asia-Pacific editor working out of our new Singapore bureau. ▼ If you're targeting Asia-Pacific, go with the magazine that corporate networkers across Asia and the Pacific Rim count on for the global perspective on today's networking technology. For information about advertising rates in *Data Communications Asia-Pacific*, just contact your local sales representative.

APPLICATION TRENDS

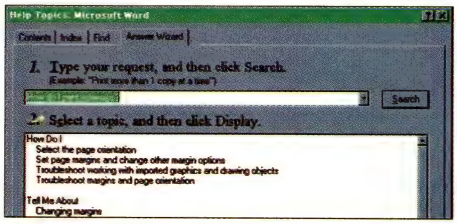
Help Gets Natural

To learn how to use the software they depend on, computer users have for years either dialed up technical-support lines or asked friends and coworkers. Now they can ask their software instead, using plain English.

A new capability, dubbed natural-language processing (NLP), allows a stumped user to type in a question such as "How do I get these numbers into a bar graph?" In response, the software directs the user to an appropriate help screen or a step-by-step tutoring routine.

These NLP features are showing up in new versions of programs from Lotus, Microsoft, Novell, and other software vendors. Microsoft's (Redmond, WA, (206) 882-8080) Office 95, for example, contains an Answer Wizard that lets you type in anything ranging from a few words to a complete statement or question in search of help.

Lotus's WordPro for Windows has a similar feature called Ask the Expert, which prompts you to complete a "How Do I" question and then takes you to the appropriate help screen.



In Microsoft's Word for Windows 95, when you ask a question such as "How do I see what this document looks like before printing?," you get a list of help topics that help answer your question.

Novell's WordPerfect Division (Orem, UT, (801) 429-7000) says it plans to apply a host of NLP features to the next edition of Perfect Office, which is due to ship by the end of this year. A query in Perfect Office will yield not only help screens but also interactive "coaches," templates, and "quick task" routines.

The next step will be to let users ask their computers questions by talking rather than by typing. Novell is already planning a 1996 or 1997 version of Perfect Office that will take NLP to the next level: voice recognition of plain-English questions. **—Chris O'Malley**

OPTIONS INCREASE, PRICES DROP FOR MAC ADD-ONS

Mac users will find a wide variety of options this fall when choosing graphics accelerators for their PCI Power Macs. The entry of such companies as ATI Technologies, Matrox, Number Nine Visual Technology, and others into the PCI-based Mac market means that Mac users can choose from a range of peripherals that cost less than comparable cards developed for the older NuBus. "There is more competitiveness now in the PCI Mac market," says Tony Bojorquez, product marketing manager for graphics cards at Radius. "Our PCI products are consistently [priced] lower across the board than comparable NuBus products," he adds. It also appears that some vendors selling PCI cards for both the Mac and PC markets will keep their prices the same. For example, Number Nine's Imagine 128 for Power Mac sells at the same price as its PC cousin. Other vendors, including Matrox and Miro, will price their Mac accelerators slightly higher. **—D.A.**

COMPANY	PRODUCT	DESCRIPTION	SUGGESTED RETAIL PRICE
ATI Technologies Thornhill, Ontario, Canada (905) 882-2600 fax: (905) 882-2620	Xclaim GA	24-bit color at up to 1152- by 870-pixel resolution (4-MB version) or 832 by 624 resolution (2-MB version)	$649 (4-MB) and $449 (2-MB)
Diamond Multimedia Systems San Jose, CA (408) 325-7000 fax: (408) 325-7070	Javelin Video 3240XL and 3400XL	24-bit color at up to 800 by 600 resolution and 24-bit color at up to 1152 by 870 resolution, respectively; both offer QuickTime video scaling and dithering acceleration	3240XL, $399; 3400XL, $569
Matrox Dorval, Quebec, Canada (514) 969-6320 fax: (514) 969-6363	MGA Millenium for the Mac	Mac version of graphics and 3-D accelerator	$649
miro Computer Products Palo Alto, CA (415) 855-0940 fax: (415) 855-9004	Five PCI cards for the Mac, including the miroChroma 1280PV	24-bit color at up to 1280 by 1024 resolution; displays and captures VHS and Super-VHS video; 30-fps QuickTime movies at up to 1280 by 1024 resolution	Price for miroChroma 1280PV undetermined
Number Nine Visual Technology Lexington, MA (617) 674-0009 fax: (617) 674-2919	Imagine 128 for the Power Mac	128-bit graphics and video accelerator; up to 1600 by 1200 resolution with 16.8 million colors (8-MB version); up to 1600 by 1200 resolution at 65,000 colors (4-MB version)	$899 (4-MB) or $1599 (8-MB)
YARC Systems Newbury Park, CA (800) 275-9272 fax: (805) 499-4048	Screamer, Hydra, and RIP	The Screamer accelerates QuickDraw 3-D applications; the dual-processor Hydra accelerates rendering; RIP converts the Canon color copier into a networked printer	$995, $1995 and up, and $14,995, respectively
Radius Sunnyvale, CA (408) 541-6100 fax: (408) 541-6150	Several products, ranging from the low-end PrecisionColor 8/1600 to the high-end ThunderColor 30/1600	24-bit color at up to 832 by 624 resolution (PrecisionColor 8/1600); 24-bit color at up to 1600 by 1200 resolution, plus DSP-accelerated Photoshop and CMYK display (ThunderColor 30/1600)	$599 for PrecisionColor 8/1600; $2499 for ThunderColor 30/1600
Radius	Thunder IV GX 1600 for NuBus	Comparable to the ThunderColor 30/1600	$3699

COREL CD OFFICE

Companion

The best CD to complete your office suite

Incredible power and value all on one convenient CD-ROM

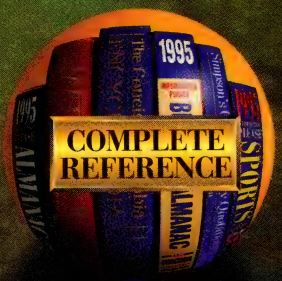
Multimedia utilities including Corel CD Audio™ and system diagnostic tools.

Manage all your high-quality TrueType® fonts with Corel FONT MASTER™.

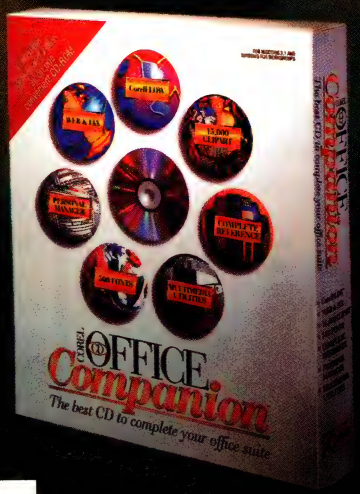
Corel PLANNER™ is the perfect Personal Information Manager that allows you to track your appointments, contacts, activities and more.

Connect to the world with Corel Web Mosaic™, an Internet browser, and CorelFAX™, fax communication software.

Corel BOOKCASE™ features Webster's II Dictionary, Columbia Encyclopedia, Simpson's Quotations, and business, sports and general almanacs.



Corel GALLERY™2* provides you with extensive libraries including 15,000 clipart images, 200 photos and a powerful multimedia file manager.



CorelFLOW™2* is ideal for creating business graphics with over 2,000 symbols, 90 Smart Symbol Libraries, a built-in spell checker and intelligent drawing features.

Microsoft is a registered trademark of Microsoft Corporation, PerfectOffice is a trademark of Novell, Inc., and SmartSuite is a registered trademark of Lotus Development Corporation. Microsoft Corporation, Novell, Inc., and Lotus Development Corporation make no endorsement of Corel or Corel CD Office Companion.

OfficeMax®
Taking Your Savings To The Max!™
1-800-788-8080

$99.90
US$ plus applicable taxes.

*Clipart, font and photo libraries vary from the standalone versions of CorelFLOW 2 and Corel GALLERY 2.

KUR-0150

COREL
custserv@corel.ca

Call now for faxed literature!
1-613-728-0826 ext. 3080
Document #1058

Circle 68 on Inquiry Card.

We are Gateway 2000

August 1985
"Hey, Mike ... call me crazy but I've had this craving all day to start a computer company!"
Ted Waitt

September 5, 1985
Congratulations, it's a computer company! Gateway 2000 is born at the Waitt Family Cattle Farm outside of Sioux City, Iowa.

August 1985
Ted's grandma, "Momo," takes a leap of faith and becomes Gateway's first principal investor securing a $10,000 loan.

April 2, 1986
The Livestock Exchange Building at the Sioux City Stockyards: Gateway's first home away from home.

February 1988
25 systems built and shipped in one day! All 10 phones ringing off the hook from Gateway's first major ad in *Computer Shopper*, "Computers from Iowa?"

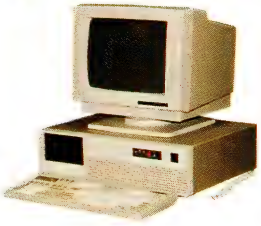
1985 Sales: $100,000
Employees: 2

1986 Sales: $1 million
Employees: 4

1987 Sales: $1.5 million
Employees: 8

1988 Sales: $11.7 million
Employees: 33

November 1985
Ted springs for Thanksgiving dinner for entire Gateway workforce (Mike Hammond).



1986
Gateway 2000 ships its first PC.

August 3, 6918
Dyslexic shipping clerk covers for Ted over lunch and becomes Gateway's first sales rep.

1987
Texas Instruments PC customers exchange TI PCs for Gateway 2000 IBM compatibles.

February 1987
Ted and Mike get sick of looking at each other. Up go the first cubicle walls!

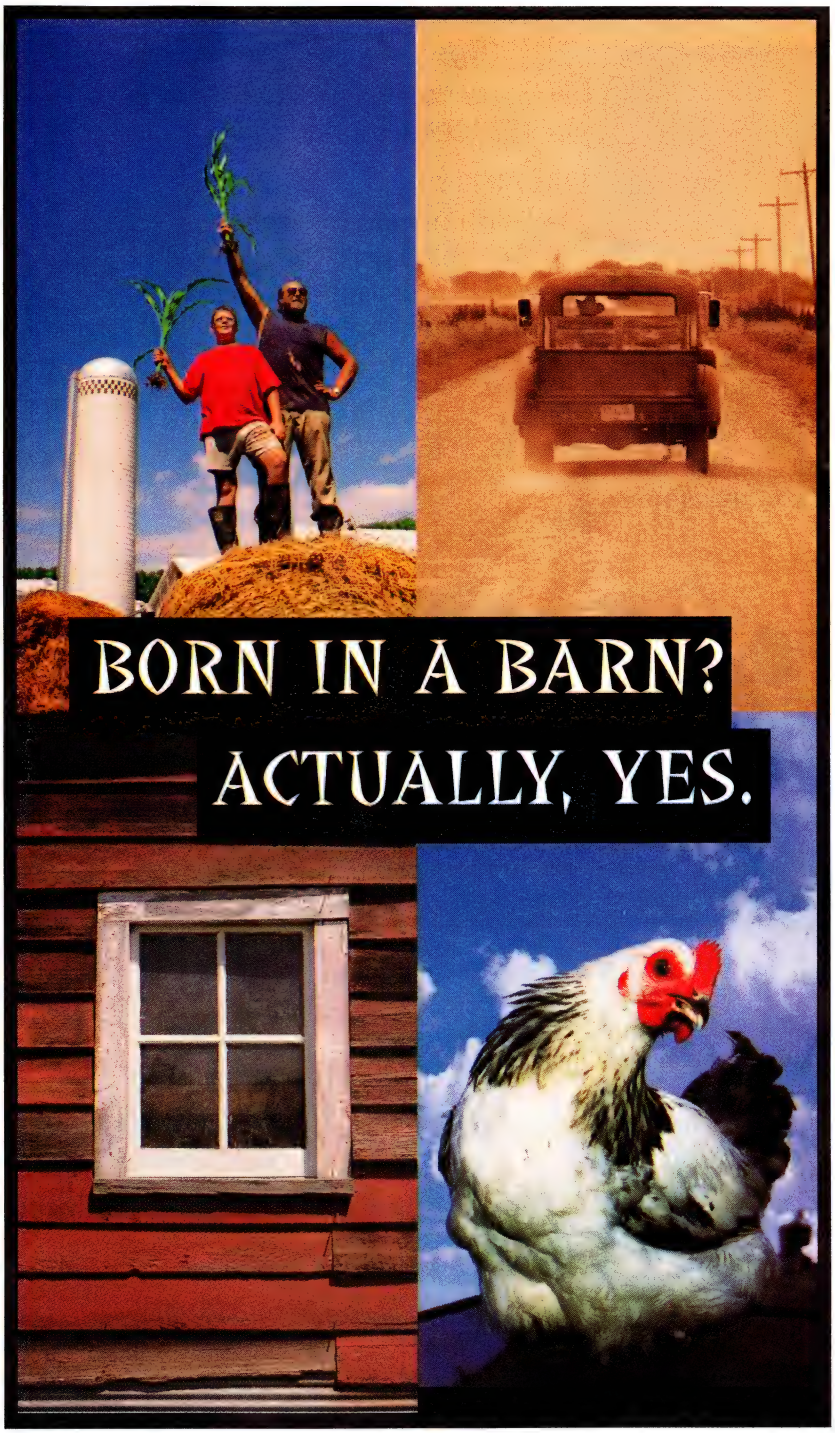
September 1988
Gateway sells 386-20 PC for $2,995, receives *Byte* magazine's Award of Distinction.

September 1988
Gateway herd finds greener pastures in Sergeant Bluff, Iowa (we moved there).

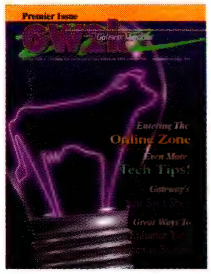
1988
Industry First!
EGA color monitors standard on all systems.

We will always be happy, but we will never be satisfied.

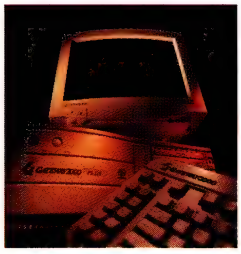
It started as a dream, born on an Iowa farm. Today, 10 years later, the same company that once clocked in by a rooster crow is recognized as the nation's PC industry leader. The Gateway 2000® secret? Give PC buyers a quality product, the latest technology, and incomparable service — all at an unparalleled value. Our hard-working employees know what it takes to get the job done right. And we're ready to outdo ourselves in the next decade and beyond.



intel inside
pentium PROCESSOR



March 1995
Premiere issue of
GW2k: Gateway Magazine.



May 1995
Gateway's P5-120 is named the "fastest PC in the world," by *PC/Computing.*

May 1995
Technical support completes 12,046 calls in one day! All techs treated to sparkling cider in plastic champagne glasses.

July 1995
Gateway ranks first among Intel/Windows PC manufacturers in brand loyalty.

10th ANNIVERSARY SYSTEM

- Intel® 133MHz Pentium® Processor
- 16MB EDO Performance-Enhanced Memory
- 256K Pipelined Burst Cache
- **1.62GB 9ms EIDE Mode 4 Hard Drive**
- PCI Enhanced IDE Interface
- **Matrox® MGA™ Millennium™ 2MB WRAM Graphics Accelerator**
- **6X EIDE CD-ROM**
- 16-Bit Ensoniq® Wavetable & **Altec™ Lansing Surround Sound Speakers w/ Subwoofer**
- **TelePath® 28.8 Fax/Modem Communication Center**
- 3.5" Diskette Drive
- **17" .26dp Vivitron™ Color Monitor**
- 9-Bay Tower Case
- **AnyKey®+ Keyboard**
- MS Mouse 2.0
- **Microsoft® Windows® 95**
- **10th Anniversary System Software Collection: MS Office 95, Professional Edition and Generations**
- **Gateway Gold™ Premium Service**

$3999

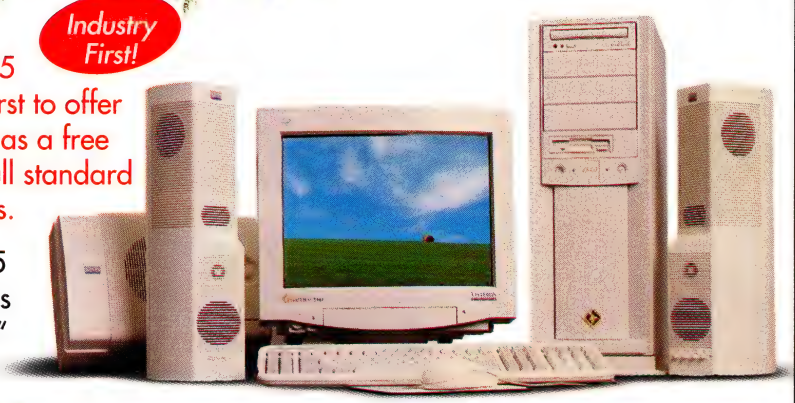
intel inside
pentium PROCESSOR

Designed for
Microsoft Windows 95

November 1994
New Gateway facility opens in Kansas City.

Industry First!

June 16, 1995
Gateway is first to offer Windows 95 as a free upgrade on all standard configurations.



July 28, 1995
Gateway goes "down under" to Australia.

December 1994
The Liberty small notebook makes its debut.

August 1, 1995
Gateway Gold Service and Support program unveiled.

GATEWAY2000
"You've got a friend in the business."®

800-846-2058

610 Gateway Drive • P.O. Box 2000 • N. Sioux City, SD 57049-2000 • Phone 605-232-2000 • TDD 800-846-1778 • Fax 605-232-2023 • FaxBack 800-846-4526
International FaxBack Access 605-232-2561 • Component Add-On Sales 800-846-2080 • Sales Hours: 7am-10pm Weekdays, 9am-4pm Saturdays (CDT)

© 1995 Gateway 2000, Inc. Gateway 2000, black-and-white spot design, "G" logo, "You've got a friend in the business" slogan and HandBook are registered trademarks, and Gateway Gold, ColorBook and Liberty are trademarks of Gateway 2000, Inc. The Intel Inside Logo, Intel and Pentium are registered trademarks of Intel Corporation. All other brands and product names are trademarks or registered trademarks of their respective companies. Monitors' diagonal measurements indicate the size of the cathode-ray tube. All prices and configurations are subject to change without notice or obligation. Prices do not include shipping or applicable sales tax.

We share the vision of being our customers' only logical choice.

Industry First!

1989
It doesn't get any better than this — standard VGA monitors!

June 1989
Gateway goes online with GW2k BBS.

December 1989
McGraw-Hill purchases 386-20s and achieves immortality as Gateway's first major Fortune 500 customer.

1989 Sales: $70.5 million
Employees: 176

1990
The population of North Sioux City reaches a whopping 2,019.

May 1990
Microsoft Windows is now standard on all Gateway systems.

Industry First!

October 1990
Gateway's first 486 system hits the market value-priced at $5,295.

1990 Sales: $275.5 million
Employees: 600

1991
Gateway becomes first company to win all four *Computer Shopper* Best Buy desktop awards.

Industry First!

February 1991
Gateway is first to introduce non-interlaced monitors on all systems.

April 1991
Gateway introduces cow-spotted boxes.

April 1991
Technical support completes a record number of 2,800 calls in one day!

1991 Sales: $626.7 million
Employees: 1,300

Industry First!

February 1992
Customers rejoice! Gateway begins offering choice of application software with new systems at no extra charge.

1992
Barely seven years old and already Microsoft PC Manufacturer of the Year.

March 1992
Technical support holding queue is empty for the first time in company history.

May 1992
Going mobile with our first portable computers, including the HandBook, the industry's first subnotebook.

Industry First!

1992 Sales: $1.1 bill
Employees: 1,850

1993
Gateway offers first Family PC multimed system for $1995.

August 1993
The ColorBook and HandBook 486 ente Gateway's stellar product lineup.

Inc F

May 1994
Gateway announces three-year warranty all desktop PCs and monitors.

July 1, 1994
Gateway opens a showroom in Paris, France.

October 1993
Holy leprechauns! Gateway Europe se up shop in Dublin, Ireland.

In

September 1993
Gateway introduces first VESA system.

October 1993
Gateway offers our first Pentium system the P5-60, for $35 and sweeps *Computer Shopper's* Bes Buy awards for thir consecutive year.

You've got a friend in the business.

INTERNET BROADCASTING

Radio Comes to Cyberspace

The golden days of radio are behind us, but a new era in audio broadcasting on the Internet is just beginning.

At least two companies have developed software for the Internet that lets you listen to audio, such as a news broadcast or a promotional sound clip, without first having to download the audio file to your hard drive. Developers are using these audio compression/delivery solutions to develop World Wide Web pages that you can see and hear. By the end of this year, more than 100 radio stations could be using these solutions to broadcast over the Internet.

Sending sound over the Internet is certainly nothing new. However, Unix AU, Mac AIFF, and Windows WAV sound files, which typically measure 1 MB or larger, are voracious consumers of network bandwidth. Popular early Internet talk-radio experiments, such as Carl Malamud's half-hour "Geek of the Week" broadcast, typically required 15 MB. It was possible to listen to "Geek of the Week" in real time, but only if you had a 64-Kbps or faster connection.

Two new audio compression/delivery systems, RealAudio from Progressive Networks (Seattle, WA) and StreamWorks from Xing Technology (Arroyo Grande, CA), allow users with slower Internet connections to enjoy audio broadcasting. RealAudio and StreamWorks both enable Web users to listen to audio without having to download a sound file first.

The quality of sound that StreamWorks and RealAudio provide will vary depending on your network connection, but you can typically expect AM-radio quality. RealAudio is designed to give you 16-bit, 8-kHz sound. At worst, you will think you're listening to an across-the-border AM radio station. At best, it sounds like a nearby AM station.

The quality of a StreamWorks broadcast can improve with higher bandwidth. Xing Technology says that users with 9600-bps to 14.4-Kbps connections can expect AM-quality radio, but at 128 Kbps the quality of the broadcast can scale all the way up to CD-quality stereo sound. StreamWorks is based on MPEG, so it can also compress video and allow Web users with ISDN connections to view full-motion video.

One application for Internet audio is to enable radio stations to reach a wider geographic audience. But there are a lot of other applications for Internet audio besides radio broadcasting (see the box "Internet Audio Applications" above), including some that haven't been thought of yet.

—Steven J. Vaughan-Nichols

INTERNET AUDIO APPLICATIONS

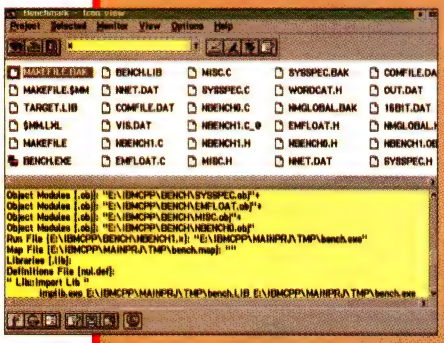
- On-demand broadcasting (e.g., for following local sports teams or political issues from anywhere in the world)
- Corporate information systems
- Web kiosks
- Long-distance training and education
- Audio libraries

CODE TALK

RICK GREHAN

A New Age for OS/2 Programmers

A new version of IBM's Visual Age C++ development environment for OS/2 combines visual development tools with a compiler that generates executable programs comparable to those generated by Watcom's C/C++. Visual Age C++ ($449 and up; for more information, call (800) 426-3333 and ask for "star 725" or contact http://www.torolab.ibm.com on the Internet), for use with OS/2 2.11 and OS/2 Warp version 3 or higher, is descended from a similarly named Smalltalk development system. In fact, most of the environment's Visual Builder component executes in Smalltalk, although you would never know it.



Visual Age's environment workframe shows a make operation in progress.

Visual Age's integrated development environment (IDE) consists of a number of interoperating tools. Although you could use Visual Age simply as a C/C++ development system, it places heavy emphasis on the paradigm of constructing an application by wiring together software "parts." This parts concept is fully realized in the Visual Builder, a classic visual development system in which you assemble programs by dragging icons (parts) out of a toolbar, dropping them into your application's window, and then defining execution behavior by linking the parts together.

I used the environment to build a window that manages a phone-list database consisting of a data-entry field, an Add button, and a listbox. When I typed a new name into the entry field and pressed the Add button, the entry field's contents were appended to the list in the listbox. Within Visual Builder, I assembled this application by first dragging and dropping the entry field, button, and listbox from a tool palette to the window. Next, I established a link between the button and the listbox by drawing a connection line between the two. The Builder then simultaneously prompts and guides you through defining what action activates the connection (pressing the button); what method in the listbox is "fired" by that action (appending an entry); and where the data associated with the method comes from (the entry field). Through all of this, you don't write one jot of C++ code; Visual Builder does it.

Along with the Visual Builder, Visual Age arrives with the usual host of development tools: browser, debugger, and performance analyzer. IBM also provides Open Class, a set of C++ class libraries that represents IBM's answer to Microsoft Foundation Classes (MFC). Visual Age can also directly generate System Object Model (SOM) objects.

The performance of executables generated by the Visual Age compiler appears to be on a par with that of my favorite compiler, Watcom C/C++. I moved the BYTEmark source code into a Visual Age project, compiled it, and got neck-and-neck results. Watcom scored indexes of .40 for the integer test and .26 for the floating-point test, while Visual Age turned in an index of .43 for integer and .24 for floating-point. (Both were run in an OS/2 full screen within Warp 3.0 on a 66-MHz 486.)

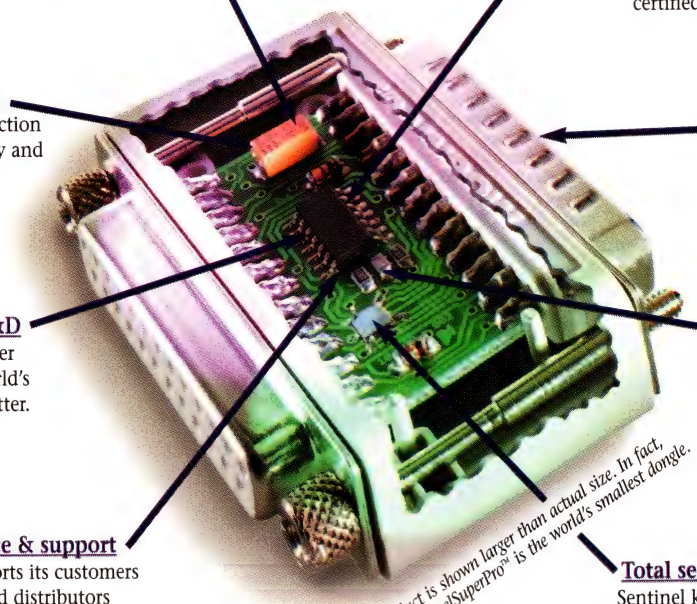
Reliability you can depend on
In 1994, Sentinel improved its industry leading reliability to over 99.985% – *far more reliable* than any other software protection product.

The industry's highest quality ISO 9002 Certified
Rainbow is the world's *only* software protection supplier with ISO 9002 certified quality standards.

Manage network licenses
NetSentinel™ is the *only* protection to undergo rigorous testing by and receive approval from Novell.

yes NetWare Tested and Approved

Truly transparent protection
Designed to go unnoticed by your customers, Sentinel does not interfere with hardware, peripherals or other software programs.



A substantial investment in R&D
In 1994 alone, Rainbow invested over $4,500,000 in R&D to make the world's leading software protection even better.

Compatible with your software
Our partnerships with Apple, Microsoft and IBM mean Sentinel protects software for any hardware or operating system.

Product is shown larger than actual size. In fact, the SentinelSuperPro™ is the world's smallest dongle.

Global service & support
Rainbow supports its customers with offices and distributors in more than 40 countries.

Total security & flexibility
Sentinel keys are available with proprietary ASIC technology, multiple EEPROM cells or even a microcontroller – giving you the world's best software protection.

ASIC NEXT GENERATION TECHNOLOGY

Why this dongle protects more software than all others combined!

Over 6,500,000 Sentinel® keys protect software worldwide. In fact, 55% of all protected software has a Sentinel key, from Rainbow Technologies.

Today, software piracy is at an all-time high. If you're selling software without protection, you're losing sales and revenue.

Start protecting your software investment. Stop software piracy with Sentinel, then watch your sales and profits increase.

Discover the Sentinel difference
Sentinel is easy to implement, transparent to your end-users, and backed by the world leader. When you need on-time delivery and global support, you need Sentinel.

Only Sentinel gives you leading-edge technology, ISO certified quality and over 99.985% reliability.

Protect your software investment
Order a *Sentinel Developer's Kit* now. Each kit comes complete with technical documentation, software drivers, utilities, and a Sentinel key.

Call the Rainbow office or distributor nearest you today.

SENTINEL
Software Protection

RAINBOW TECHNOLOGIES

WORLD HEADQUARTERS: 50 Technology Drive, Irvine, CA 92718 ■ Tel: 714/450-7300 ■ Fax: 714/450-7450
ASIA/LATIN AMERICA: 714/450-7300 ■ **U.K.:** (44) 1932 570066 ■ **FRANCE:** (33) 1 41 43 2900 ■ **GERMANY:** (49) 89 32 17 98 0
VISIT THE RAINBOW TECHNOLOGIES HOME PAGE AT: http://www.RNBO.COM

ARGENTINA: Agri-Aid, S.A. 54 1 8030536
AUSTRALIA: LOADPLAN 61 3 690 0455
BELGIUM/LUXEMBURG: E2S 32 92 21 11 17
BRAZIL: MIPS Sistemas Ltda. 55 11 574 8686
BULGARIA: KSIMETRO 35 9279 1478
CHILE: ChileSoft Ltda. 56 2 2327617
CHINA (Eastern): Shanghai Pudong Software Park Development Company 86 21 4371500
CHINA (Northern): CS&S 86 10 8316524
COLOMBIA: Construdata 57 1 610 7500
CZECH REPUBLIC: ASKON Int'l 42 2 3103 652
GREECE: Byte Computer S.A. 301 924 17 28
HONG KONG: Computers & Peripherals 852 2515 0018
HUNGARY: Polyware Kft 36 76 481 236
INDONESIA P.T. Promptrade InfoScan 62 21 375 166
IRAN: GAM Electronics 98 21 22 22374
ITALY: BFI IBEXSA SPA 39 23 31 00535
ITALY: Siosistemi 39 30 24 21074
JAPAN: Giken Shoji Co., Ltd. 81 52 972 6544
JORDAN: CDG Engineering 96 26 863 861
KOREA: Genesis Technologies 82 2 578 3528
LEBANON: National Group Consultants 961 1 494317
MALAYSIA: Eastern Sys. Design (M) Sdn Bhd 60 3 241 1188
MEXICO: Impex Comp., S.A. de C. V. 52 66 210 291
MIDDLE EAST: Hoche Int'l 44 81 459 8822
MOROCCO: Futur & Soft 212 2 40 03 97
NETHERLANDS: IntroCom 31 74 430 105
PHILIPPINES Mannasoft Tech. Corp. 63 2 813 4162
POLAND: HITEX Sp. z o.o. 48 22 41 97 51
PORTUGAL: COMELTA 351 1 941 65 07
SCANDINAVIA: Perico A/S 47 2249 1500
SINGAPORE: Systems Design PTE LTD 65 747 2266
SPAIN: MECCO 34 3 422 7700
SWITZERLAND: IBV AG 41 1741 2140
SWITZERLAND: Safe Compaid S.A. 41 2421 5386
TAIWAN: Evershine Tech. 886 2 8208925
THAILAND: BCS Int'l 66 2 319 4451
TUNISIA: ASCI 216 1 781 751
TURKEY: BIMEKS, Ltd. 90 216 348 3508
VENEZUELA: HRT-M Osers 58 2 261 4282

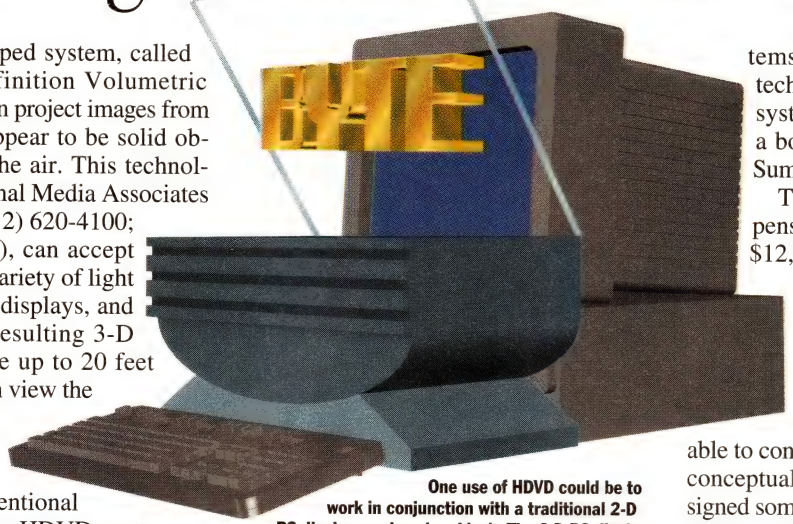
©1995 Rainbow Technologies, Inc. Sentinel, SentinelSuperPro and NetSentinel are trademarks of Rainbow Technologies. All other product names are trademarks of their respective owners.

Circle 96 on Inquiry Card.

FUTURE DISPLAY TECHNOLOGIES

3-D Images That Float in Air

A newly developed system, called the High Definition Volumetric Display (HDVD), can project images from a PC so that they appear to be solid objects suspended in the air. This technology, from Dimensional Media Associates (New York, NY, (212) 620-4100; fax (212) 620-7771), can accept 2-D images from a variety of light sources, such as PC displays, and project them. The resulting 3-D aerial images can be up to 20 feet in width, and you can view the images under a variety of lighting conditions.



One use of HDVD could be to work in conjunction with a traditional 2-D PC display, such as in a kiosk. The 2-D PC display could show data on the computer's monitor while you view a 3-D display that hovers in front of the PC.

Projecting a conventional PC screen through an HDVD system results in a floating plane that displays real-time stationary and full-motion images. By generating and displaying image objects in a special format, a PC has the ability to act as a source of true 3-D images that can be viewed at different angles. "What we have is technology that's unencumbered by 3-D glasses or virtual-reality headsets," says Susan Kasen Summer, DMA's chairwoman. "It gives consumers a new way of viewing the software that they already have on their PCs."

HDVD systems might one day enable businesspeople to give 3-D presentations. There are also numerous possible applications in such areas as education, museum and trade-show kiosks, entertainment, the military, and the medical field, which has already begun investigating its use in surgical rehearsal.

"HDVD is going to play an interesting role in the evolution of advanced display technology," says Jeff Marshall, senior managing director at Bear Stearns (New York, NY), a brokerage firm that specializes in high technology. "We are encouraged that they have been able to develop the technology this far—and even more encouraged by the possibilities of future applications."

For now, no directly competing technologies appear to exist. Although other 3-D systems are in development, including goggle-based virtual-reality viewing systems and Sanyo's image-splitting technology, they aren't projection systems. "It's still an image inside a box; it's not in free space," says Summer of HDVD's competition.

Today, HDVD technology is expensive (base prices begin at about $12,000) and, as a result, currently out of the reach of consumer products. DMA holds the exclusive patent on the technology and is now working with established hardware vendors to make the technology available to consumers at a lower price (see the conceptual illustration at left). "We have signed some multinational contracts, which will be announced," says Summer, "and I think that by the beginning of the year, you'll see it [HDVD] in some consumer products." Adds Marshall: "Within the next two to three years, I expect to see the new wave of display technology and applications in wide use."

—Wayne Kawamoto

INTERNET E-MAIL

Coming: (Almost) Free Internet E-Mail

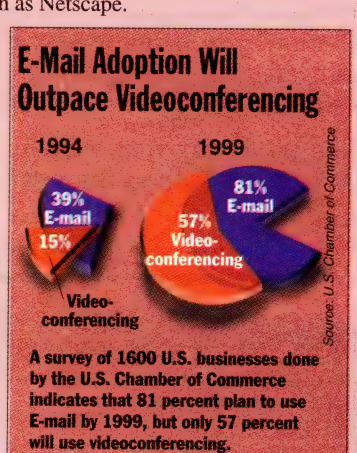
When someone offers you something for nothing, there's usually a catch. In the case of free Internet E-mail, the catch is the same one that comes with free TV: advertising.

Two companies, Freemark Communications (Cambridge, MA) and Juno Internet Services (New York, NY), are launching free, completely advertiser supported E-mail programs this fall. Both programs run on Windows, and both companies plan to offer Mac versions in 1996. Both products use proprietary interfaces and Internet connections. Thus, you won't be able to use their connections with another E-mail program, such as QualComm's Eudora, or another Internet application, such as Netscape.

The target audience of these products is people with little or no on-line experience. The idea behind each program is that while interest in the Internet and the World Wide Web is high, E-mail is currently the most popular application on the Internet and is growing in importance (see the chart). These free services are tailored for those who want just E-mail. The "price" you must pay is reading the ads that are attached to your incoming E-mail. Users may object to having to read these ads, but Prodigy has already shown that it's possible to combine advertising with an on-line service.

Both Juno and Freemark support basic E-mail only; neither supports Multipurpose Internet Mail Extensions (MIME) for binary attachments. Freemark will provide a toll-free phone number for nationwide network connectivity in the U.S. At press time, Juno said it may offer toll-free phone numbers, X.25 WANs, and local phone numbers. Juno can be reached at http://www.juno.com, and Freemark at http://www.freemark.com/. Considering the minimal cost of using a conventional on-line service ($100 to $200 annually) for E-mail, however, only the most cost-conscious users are likely to find either service of much interest.

—S. J. V.-N.



A survey of 1600 U.S. businesses done by the U.S. Chamber of Commerce indicates that 81 percent plan to use E-mail by 1999, but only 57 percent will use videoconferencing.

SIEMENS
NIXDORF

CLIENT-SERVER NEWS

More efficient, faster, and more flexible – the superiority of client-server architectures is being confirmed in a great many branches of industry. Customers of Siemens Nixdorf explain how they have profited from client-server computing. Success stories with open server systems from the worlds of UNIX and BS2000/OSD: gtz GmbH, Rodenstock, the Swiss Federal Tax Authority in Bern, British Shoe, TCD and START Informatik.

Success story "gtz GmbH"

"In the IT sector, too, reducing costs and improving responsiveness have become the central task. In PRISMA we have succeeded in developing an IT model on a client-server basis which provides the appropriate response to this challenge."

H. Henke, Manager of Information Processing, gtz GmbH.

The Deutsche Gesellschaft für technische Zusammenarbeit (gtz) GmbH plans and implements development aid projects all over the world on behalf of the Federal German Government. It is a private-law company with its head office in Eschborn, near Frankfurt, and 60 offices around the world. It is currently running some 1200 projects in more than 120 countries. The projects range from well-drilling and the exploitation of alternative energy sources (photovoltaics, biogas etc.) right through to complex EDP projects, such as supporting the first free elections in Nicaragua and IT organization at the Chinese Patent Office.

PRISMA – a new IT structure boosts efficiency

The fact that gtz is active throughout the world means that its IT tools have to be particularly efficient, matching the decentralized corporate structure. In order to rationalize working procedures, improve the information base and facilitate communication, the users and computer scientists at gtz got together to develop their own IT project, which became known as PRISMA (PRoject, Information, Support and MAnagement system). PRISMA uses OfficeWorld as its base; the "Office Communication" module developed for PRISMA provides employees with an elec-

SIEMENS NIXDORF

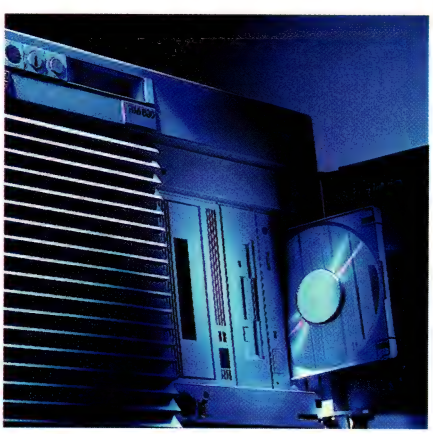
Well construction in Haiti

tronic desktop (ComfoDesk) with electronic mail (X.400, X.500, fax and Internet) and a filing service, as well as access to the central BS2000 server. The PRISMA model also comprises a project processing system on the basis of the "Workparty" workflow component and the R/3-LIVE*) development environment, together with a differentiated information system consisting of AIS and EIS (user-specific and decision-maker-specific information systems respectively).

In addition to its central BS2000/OSD server, gtz uses SNI RM600 UNIX*) systems as decentralized production and backup servers for PRISMA in conjunction with powerful PCs from the PCD-5E series running under Netware 4.1.

Rationalization for the benefit of the user

After completion of a pilot phase with 150 people taking part, there are now 1000 users connected to PRISMA. The modules that have been put in place so far have been accepted across the board as having genuinely reduced the workload."In particular it is the user-friendly graphical interface, ComfoDesk, which helps the new system to gain acceptance quickly", explains Information Processing Manager Henke. "The central BS2000 server continues to provide excellent reliability and performance, and this, together with the recently introduced version of R/3 from SNI (R/3-LIVE) on RM600 systems, which fits in neatly with existing R/2 and R/3*) applications, has shown our choice of Siemens Nixdorf as our full supplier and development partner to have been the correct one."



*) R/3 LIVE® is a registered trademark of Siemens Nixdorf

*) UNIX® is a registered trademark in the United States and other countries, licensed exclusively through X/OPEN Company Ltd.

*) R/3 and R/3 are licensed products of SAP.

Success story "British Shoe"

"I asked the question: who is running enterprise systems in this portable, scalable environment? It did not take long before all the signs were pointing one way: at PYRAMID. PYRAMID have made enterprise computing their business."

John Wheeler, Information Systems Director, British Shoe

It was in the face of increasing customer pressure that British Shoe decided to change the face of shoe retailing in the UK. The company sells 50 million pairs of shoes through 1700 outlets across the country via familiar brand names, and yet the business was not generating the returns it should have been.

The existing IT structure was based on an IBM mainframe with a number of PCs which resulted in islands of information. There was no way of achieving an overall vision of the company with this system, so the IS team defined four basic rules for the new systems architecture:

- one terminal giving consistent access to all systems and information
- relational data storage
- one single logical database
- integrated functions

Based on these rules, British Shoe came up with their technical vision – they wanted client server sytems, scalability and portability. The decision was quickly taken to base all new systems on Oracle, and selecting the hardware platform was another key area. Pyramid's proven market experience was a critical factor for British Shoe, who required an understanding of business issues which necessitate systems which run 24 hours a day, seven days a week with security, reliability and robustness.

British Shoe purchased two Nile servers on which to run a purchase order and supply chain management system. The ambition is total automation – information on stock is transmitted to the store inventory system which, at the end of each day, calculates what it needs to get back to stock levels. The stores are polled 11,500 times a day to access sales, stock and distribution needs. The need for resilience and reliability in this system is therefore very clear.

The company is now handling the design and styling of shoes based on fashion trends, and uses direct sourcing to move the

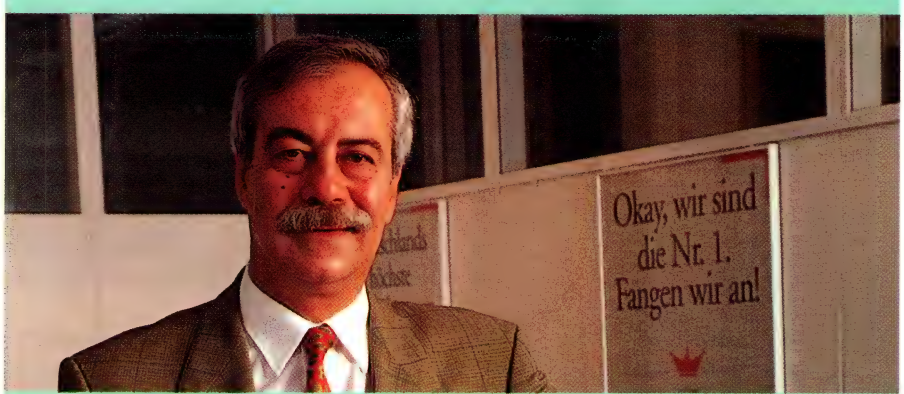
product from being an idea through being a sample to a production item and place it in the best factories around the world for that type of merchandise.

The first results of the implementation can already be seen, with the launch of Shoe Express as a new concept in UK shoe retailing. In addition, the company has established its first direct sourcing operation, British Shoe International, based in Taipei, Taiwan – the next major task is to provide online access to the new systems from Taipei. British shoe is beginning to realize its new IS vision – one that maps straight on to the business vision.

PYRAMID® TECHNOLOGY
A Siemens Nixdorf Company

SIEMENS
NIXDORF

Success Story "START Informatik"



"More than 12,900 travel agencies are hooked up to our booking system in Europe. For this, we need a computer network that can handle thousands of reservations at a time. But most important, we need one we can rely on 100 per cent."

Wassilios Dedes, Managing Director of START Informatik.

START is Europe's largest travel sales system and is synonymous with one of the greatest challenges faced by BS2000. More than 26,000 PCs and terminals in over 12,900 travel agencies operate together in the START network. Flights, package tours, hotels, rental cars, trains, ocean travel, bus tours, insurance and admission tickets – all can be booked using START, and all bookings flow together into the START computer center in Frankfurt. "That´s why I need a mainframe system that can handle extremely data-intensive applications quickly and with 100% reliability, " says Wassilios Dedes, Managing Director of START Informatik.

Thousands of bookings simultaneously at peak times

All START customers can access the BS2000 system, either from a PC in the travel office or from self-service terminals. According to Wassilios Dedes, there are several thousand bookings coming through the system at peak times for the BS2000 to process simultaneously. And, thanks to the most advanced technology, it does so at incredible speed. This makes START the largest OLTP (Online Transaction Processing) application for BS2000 systems in Germany.

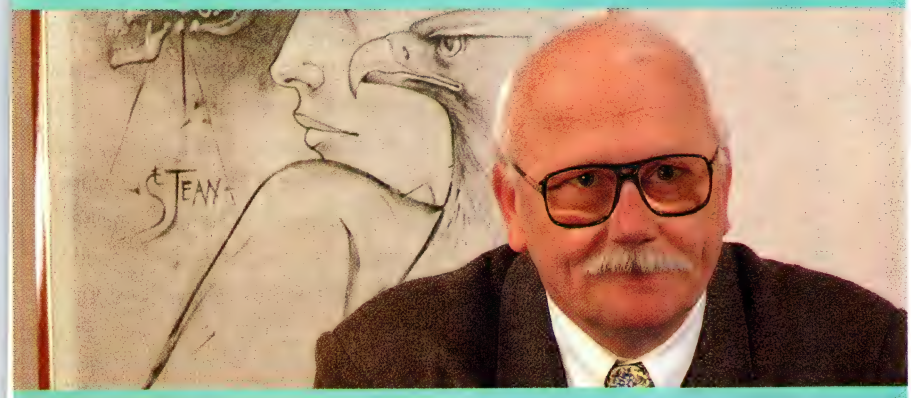
Even with 4.3 million bookings each year, the BS2000 is never booked out.

The figures bear out the performance: by 1993, 78 million bookings had been made and about 116 admission tickets had been issued. And yet the BS2000 computers still have room to spare. Wassilios Dedes points out that this spare capacity is needed to cope with the new START users being added each year.

The START network grows bigger every day

Every year, new countries join the START network. Since last year, Greece, Hungary and Poland have been making bookings via START. Branches in Turkey and Russia were added recently. About 3330 new connections were put in place last year alone. BS2000 technology plays an important part in all of these.

Success story "TCD Insurance Institute"



"The association between TCD and Siemens Nixdorf is far more than the normal relationship between a customer and his supplier. From the start, we found we could rely completely on the SNI team's commitment. This resulted in a feeling of trust and a genuine partnership between the two companies."

Marc Boey, TCD Director, Accountancy and Data Processing

The insurance broker Thibaut, Colson and De Nef, founded in 1933, is one of the oldest and most reputable companies in the insurance business in Belgium. Since its cooperation agreement with the banking house Génerale de Banque in 1986 and the resultant expansion of its range of services, TCD's annual turnover has increased from BEF 85 million to more than BEF 650 million.

Client-server systems for better customer service

In 1994 TCD decided to introduce a uniform software platform on RM series client-server systems from Siemens Nixdorf so as to have an IT structure which would do justice to the increasing expansion of the company's activities. The object of this migration was company-wide distributed information access – PCs and terminals with direct access to the R/3 application in a client-server architecture – to give traders and representatives the means to react very quickly to customer requests. A second objective was to optimize accountancy processes and transform the accountants department from a passive accounting office into an active information tool to aid decision-making.

Better safe than sorry: R/3 LIVE on RM systems from SNI

After evaluating a number of proposals, the company decided on R/3 LIVE, the standard Siemens Nixdorf implementation of SAP R/3. "We were immediately convinced by R/3," says Marc Boey, director of accountancy and data processing at TCD. "Its structure matched our requirements in every respect: it was user-friendly, flexible and open. But what impressed us most was the total package concept from Siemens Nixdorf. In next to no time, we received an extremely competitive offer for the complete package consisting of hardware (a UNIX platform based on the RM 400 series), software, analysis, installation and training. And all at a fixed price with a guaranteed delivery date."

The timing aspect was one of TCD's main worries. Marc Boey reports, "The initial contact with Siemens Nixdorf was at the beginning of July 1994. The new system was scheduled to go on-line in January 1995."

Siemens Nixdorf accepted the challenge and came through with flying colours. The SNI experts planned and implemented the whole project within five months to TCD's complete satisfaction. Marc Boey: "Our accountancy with R/3 LIVE is the driving force for our future development, a strategic tool with which to consolidate and expand our market position."

SIEMENS NIXDORF

Success story "Rodenstock subsidiary RODIS Informationssysteme GmbH"

"Our entry into the world of UNIX/Windows NT while at the same time being faced with rising performance demands in the mainframe sector calls for a flexible IT concept that can be adapted dynamically to changing resource requirements. Siemens Nixdorf developed a custom solution for us, tailored to suit not only our technological needs but our financial circumstances as well."
Siegfried Merk, Managing Director of RODIS Informationssysteme GmbH

Since April 1994, the former Information Technology Division of Optische Werke G. Rodenstock has been an independent service company. The newly founded RODIS Informationssysteme GmbH now not only serves the Rodenstock Group, it is also an expert EDP partner for other companies. It concentrates on the SAP sector with outsourcing services and consultation for R/2 and R/3, but also provides system services in the desktop and communication fields.

A new IT concept for Rodenstock ...

The core business for RODIS, though, is still IT management for the Rodenstock Group. The reorganization of the IT scene within the Group, begun in 1994, is therefore the most important of its current assignments. In response to the new decentralized organizational structure of the Rodenstock Group, by mid-1997 a large proportion of all corporate processes is to be transferred to UNIX/Windows NT systems in the Siemens Nixdorf

RM family.

"We have decided to go for R/3 across the Group," explained RODIS Managing Director Siegfried Merk. The purpose of this switch is to allow customized, process-oriented adaptation of previously used R/2 applications to the individual requirements of the autonomous divisions. The first internal SAP R/3 applications have already been successfully implemented.

While further R/3 introductions continue, too, the changeover from R/2 to R/3 will take place step by step, in coexistence with the proven BS2000 mainframe system. This system, equipped with an SNI H100 F, will remain in service in the future. As more and more resources of the central computer system are released, they can be used for new outsourcing business with external customers.

... with a new method of financing

What set the ball rolling for RODIS to embark on this forward-looking strategy was the offer made by the Siemens financing company GVD Leasing GmbH to provide finance for the conversion to R/3 and the procurement of the BS2000 server as part of a demand-oriented multi-phase plan. This was a dynamic funding model in which the investment costs are linked to the capacity requirements arising at various stages – truly a financially attractive solution for RODIS from GVD Leasing.

Success story "Swiss Federal Tax Authority, Bern"

"We can't afford to experiment, and that is why we work with BS2000/OSD. So far our experience has been the best possible. The system is totally reliable and extremely flexible. BS2000/OSD also plays an important part in client-server applications."
Jean-Pierre Leuenberger, Head of Data Processing at the Swiss Federal Tax Authority, Bern.

The average citizen has little patience with mistakes and omissions when faced with a tax demand. Least of all in Switzerland, where the legendary precision is expected in all things. The responsibility borne by the 53 staff at the IT division of the Swiss Federal Tax Authority is therefore very large indeed.

The application to suit the situation

To handle the various tax groups for the Federal Government, they use more than 600 programs, most of them developed in-house, which all have to run without a hitch. Some 200 of them are OLTP applications, the other 400 are batch programs. "Batch may sound old-fashioned to a layman" says Mr. Leuenberger, head of data processing, "but just look how many batch programs are still in use with the major DP users, and will remain so. In the discussion about client-server operations, what actually happens in practice is often played down."

The latest technology for the good of the citizen

There are over 800 PC workpaces in the various administration buildings belonging to the tax authority; they are networked with TCP/IP and are served directly on the LAN from the BS2000/OSD computer center. "VM 2000 gives us two virtual BS2000/OSD machines for development and production in one H100 computer. Together with an H60 they form the backbone of an IT solution with the very latest peripherals," explains Jean-Pierre Leuenberger, pointing with no little pride to the disk storage systems with a total of 40 Gigabytes of capacity and the four-drive high-speed magnetic tape cartridge systems. Speed and reliability are guaranteed by a robot cartridge changer for archival, which is installed in a separate room but is directly linked to the H100 via an ESCON channel. The two high-performance printers at the Federal Tax Authority produce 10 million pages of tax forms per year.

Bern, Zeitglocken-Uhrenspiel

A sound basis for the future

The Swiss Federal Tax Authority has also played safe when it comes to networking. The SNI High-Speed Net Connect supports both OSI and TCP/IP protocols, and it provides BS2000/OSD with options for connection to the entire world of network technologies (such as the Internet, FDDI and ATM). Jean-Pierre Leuenberger has more to say: "Our vision is to move away from the concept of the data computer to the technique of data handling, in other words transferring the computing power to decentralized department-based computers and optimum data storage in a central data server with a modern computer center setup. The openness of BS2000/OSD is the guarantee that a customized client-server network can also be implemented with other system environments."

SIEMENS NIXDORF

Client-Server-Computing with UNIX and BS2000/OSD – openness across the board.

Whether mid-range or mainframe systems, hardware platforms from Siemens Nixdorf offer flexibility, scalable performance and long-term investment security for any client-server configuration.

Optimal PC link

Perfect interoperation between PCs and the server is assured thanks to standard interfaces. The user interface for the various services (such as mail, archival and database applications) is integrated in the familiar office software environment.

Maximum availability

SNI's server family is designed around a modular, graded security concept aimed at satisfying every individual need. Advanced RAID technologies, sophisticated recovery systems and our best-of-class openUTM transaction monitors guarantee round-the clock availability of all IT services.

Integration in the network

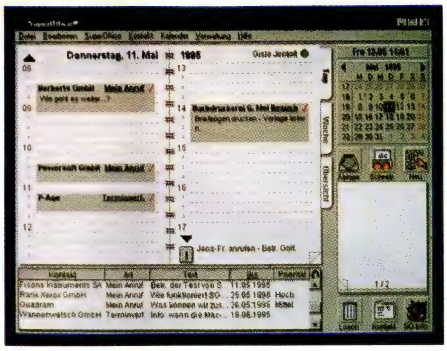
Ethernet, Token Ring, FDDI, ATM, X.21 or X.25 – the ability of our servers to be integrated in a network knows no bounds. You are also free to choose whichever protocol you please - from open standards such as TCP/IP and OSI to mainframe links using SNA or NEA. Connections to other host systems are therefore no problem for SNI servers.

The reply card which was attached here
has unfortunately disappeared.
For more informationen, contact:

Siemens Nixdorf
Informationssysteme GmbH
Z 043
Würzburger Straße 121
D-90766 Fürth
Fax 0049 911/978-3321

U24019-J-Z121-1-7600 100417/A0135

BYTE EXTRA



SuperOffice 3.0

is a full-featured contact management program that also offers interoffice E-mail, group scheduling, and international customization.

page 48IS 26

International Edition

ISDN: The Best Way to Connect Branch Offices

page 48IS 11

For embedded real-time

applications, Force Computers has developed the IBC-60x boards based on the 603/604 PowerPC processors.

page 48IS 21

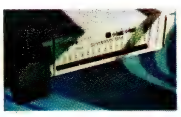
Tadpole's new SparcBook

3GX comes with built-in ISDN, a 110-MHz MicroSparc II processor and a 1.2-GB SCSI disk for performance-driven applications such as CAD modeling and simulation.

page 48IS 22

ML Electro-Optics'

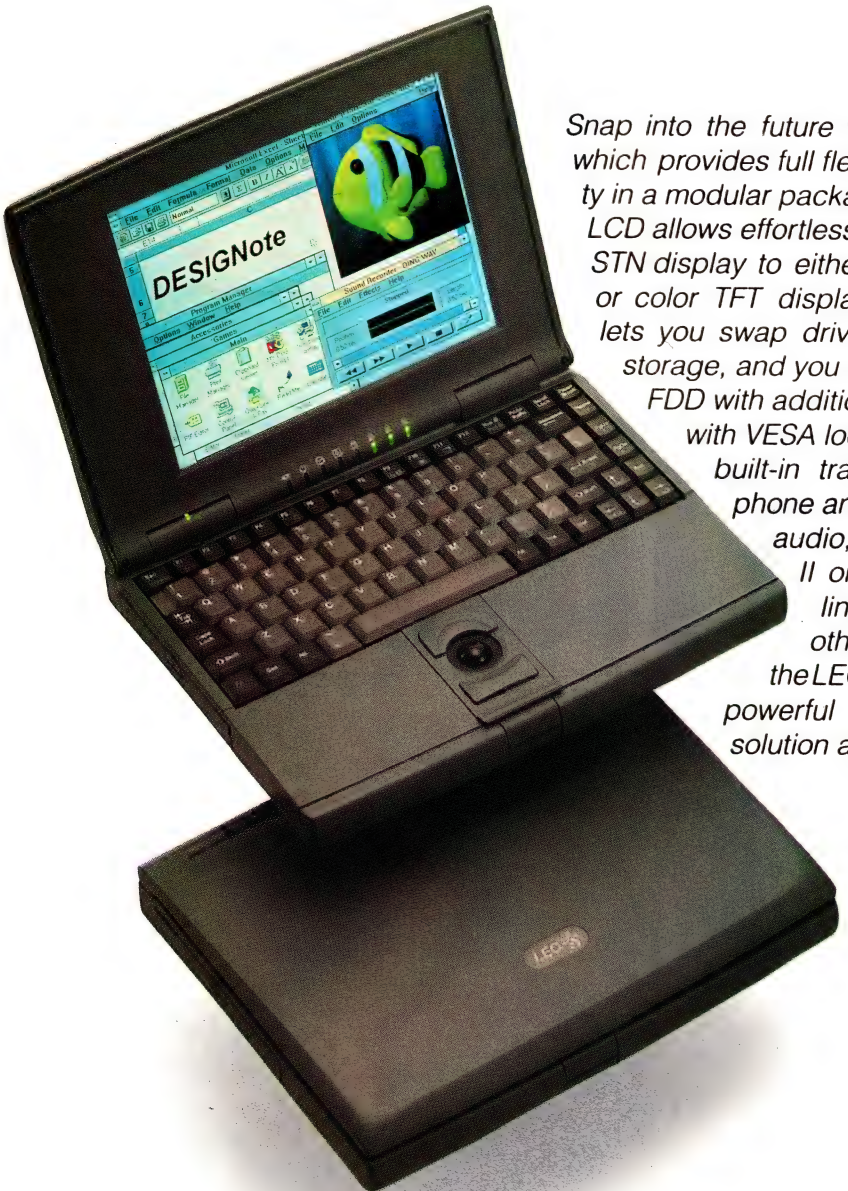
new 16-port Ethernet switch, the PlexSwitch 5016, helps maximize Ethernet bandwidth.



page 48IS 23

ILLUSTRATION: DON ARDAY © 1995

THE SMART ALTERNATIVE..



Snap into the future with the LEO DESIGNote which provides full flexibility and upgradeability in a modular package. The interchangeable LCD allows effortless upgrades from a mono STN display to either a color dual-scan STN or color TFT display. The removable HDD lets you swap drives with up to 500 MB of storage, and you can also replace the 3.5" FDD with additional modules.Intergrated with VESA local bus VGA Graphics, a built-in trackball, a built-in microphone and speaker for on-board audio, ports for PCMCIA type II or III, a choice from a full line of CPUs, and a host of other innovative features, the LEO DESIGNote is the most powerful and versatile notebook solution around.

intel inside

... LEO DESIGNote

Authorized Distributor:

BADER AL MULLA & BROTHERS CO.W.LL (KUWAIT)
TEL:965-244-5040 FAX:965-243-7285

AMERICAN TECHNOLOGIES, INC. (PHILIPPINES)
TEL:63-2-774002 FAX:63-2-788629

CENTERPRISE INTERNATIONAL LIMITED. (UK)
TEL:44-256-463754 FAX:44-256-843174

GOOD LUCK IMPORT EXPORT Co,Ltd. (THAILAND)
TEL:662-2132800 FAX:662-2125810

ICL INTERNATIONAL COMPUTER (SA) (PTY) LTD. (SA)
TEL:27-11-3141023 FAX:27-11-314-2299

JETDATA AB. (SWEDEN)
TEL:46-8-960985 FAX:46-8-960069

I.V. INDUSTRIE VERMITTLUNG & FINANZIERUNG SPOL S R. O.
TEL:42-1998-2629 FAX:42-1998-2572

NATION-TECH SDN.BHD. (MALAYSIA)
TEL:60-3-9053878 FAX:60-3-9051357

WIRAINDO MULTISAKTI SETIAPUTRA.P.T.(INDONESIA)
TEL:62-21-6256975 FAX:62-21-6010184

AL READ AL ARABIA COMPUTER CORP. (JORDAN)
(LEO MIDDLE EAST REPRESENTATIVE)
TEL:962-6-683754 FAX:962-6-683754

SEH COMPUTER-SYSTEME-VERTRIEBS GMBH. (GERMANY)
TEL:49-6184-95010 FAX:49-6184-950188

IT S VERY WELL MADE IN TAIWAN

FIC

6F, FORMOSA PLASTICS REAR BUILDING
201, TUNG HWA NORTH ROAD,
TAIPEI, TAIWAN
Tel: 886-2-7174500 Fax: 886-2-7182782
Telex 23056 Charlene

First International Computer, Inc.

FIC EUROPE B.V.	Tel: 31-73-273300	Fax: 31-73-231412	**FIC SPAIN**	Tel: 34-1-6373502	Fax: 34-1-6373863
FIC USA	Tel: 1-510-2527777	Fax: 1-510-2528888	**FIC HK**	Tel: 852-2-3453599	Fax: 852-2-7972408
FIC AUSTRALIA	Tel: 61-2-7484566	Fax: 61-2-7484633	**FIC CZECH**	Tel: 42-5-41122643	Fax: 42-5-41213144
FIC JAPAN	Tel: 81-3-5461-2181	Fax: 81-3-5461-2345	**FIC FRANCE**	Tel: 33-1-46810203	Fax: 33-1-45739885

Specifications subject to change without notice. The Intel Inside logo is a trademark of Intel Corporation.

Circle 523 on Inquiry Card.

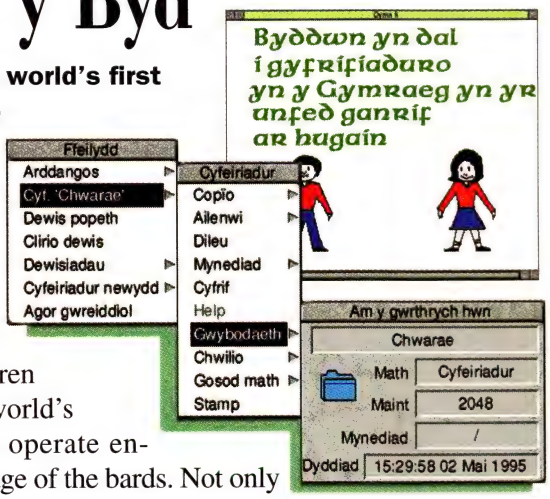
News & Views

UPDATE:

Cyfrifiadur Cymraeg Cyntaf y Byd

Translation: **The world's first Welsh computer**

JIM NAGEL



We will speak Welsh in the twenty-first century," the children typed, using the world's first computer to operate entirely in the language of the bards. Not only are all the menus and system messages in Welsh, but the computer also sorts in the order of the Welsh alphabet rather than that of English. The keyboard easily accents all seven vowels (including w and y), and the machine comes with a suite of applications including text and bit-map editors and vector drawing tools.

The project was a joint effort by MEU Cymru (the Microelectronics in Education Unit for Wales; phone +44 1443 84 1790) and Acorn Computers, which has been supplying 32-bit RISC machines to British schools since 1987.

"The aim was that when you switch it on, the whole thing communicates with you in Welsh," explained Magi Buck of the MEU Cymru. "We felt it was psychologically important for children in Wales—where there's been a strong effort to keep the language alive—to feel up-to-date in the twentieth century."

The center is also working on a Mac-based multimedia program for teaching Welsh to adults. "It's amazing how many Welsh-speakers live in the United States and Canada," she said.

UnixWare 2.0 Moves to Intel PCs

ICL, Siemens Nixdorf, and Olivetti will deploy Novell's UnixWare 2.0 on their Intel-powered computers. This announcement boosts Novell's European effort to make UnixWare the standard Unix on Intel platforms.

Siemens Nixdorf committed to port several middleware applications of its own Unix derivative, Sinix, to UnixWare. In addition to its Intel computers, ICL said it would move UnixWare to its SPARC machines by the end of this year. And UnixWare will be running on Olivetti Intel servers in the same time period.

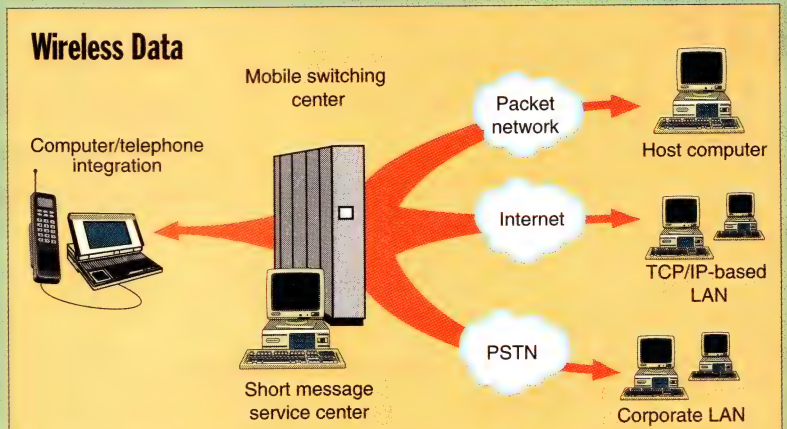
Novell also announced a partnership with EUnet, one of Europe's biggest Internet suppliers. The companies will offer products that provide Internet access to the users of Novell's network products. Novell's software will be bundled with a number of EUnet's services to provide a one-stop solution for full Internet access.

EUnet Traveler will be combined with Novell's LAN Workplace 5. That bundle will provide remote Internet access to individuals on the road anywhere in Europe. Another product, the combination of Inter-EUnet and NetWare MPR 3.0, will let organizations provide corporate Internet access to their remote offices. **— Rainer Mauth**

GSM Meets TAPI

Global System for Mobile communications (GSM) is becoming the de facto global digital cellular standard. GSM also supports data communications and will be integrating computer telephony into its network.

Windows 95 and a new telephony API (TAPI) software development kit will bring the mobile worker new communications applications. TAPI presents a common telephony API to application developers. Nokia worked closely with Intel to add GSM extensions to Intel and Microsoft's TAPI software development kit. With these extensions, third-party developers can access a Nokia cellular phone from a Windows application. Commercial applications should be starting to appear by the time you read this. **—Bob Emmerson**



A new TAPI development kit for GSM enables telephony applications on cellular phones. In the near future, when the General Packet Radio Service (GPRS) packet network is in place, Internet browsing over GSM will be possible.

CA1516CL

CA1716CL

"CHIP TIP" Award

Strongly Recommended

Smile CA 1516CL

CHIP TIP Juli 1995

..... The radiation measuring shows that the monitor to be within MPR II and in some aspects is superior to TCO 92 monitors.

123 CHIP Magazine July 1995

The clearly arranged user elements and the LCD for the display status make it very easily to use. .....because of the good picture quality the adjustment functions are almost never used.

Circle 520 on Inquiry Card.

COMDEX/Fall'95
November 13-17, 1995
Las Vegas, Nevada USA
Booth #S3518

energy

SMILE
GIVE ME A SMILE

SMILE USA
TEL : 714-5460336
FAX: 714-5460315

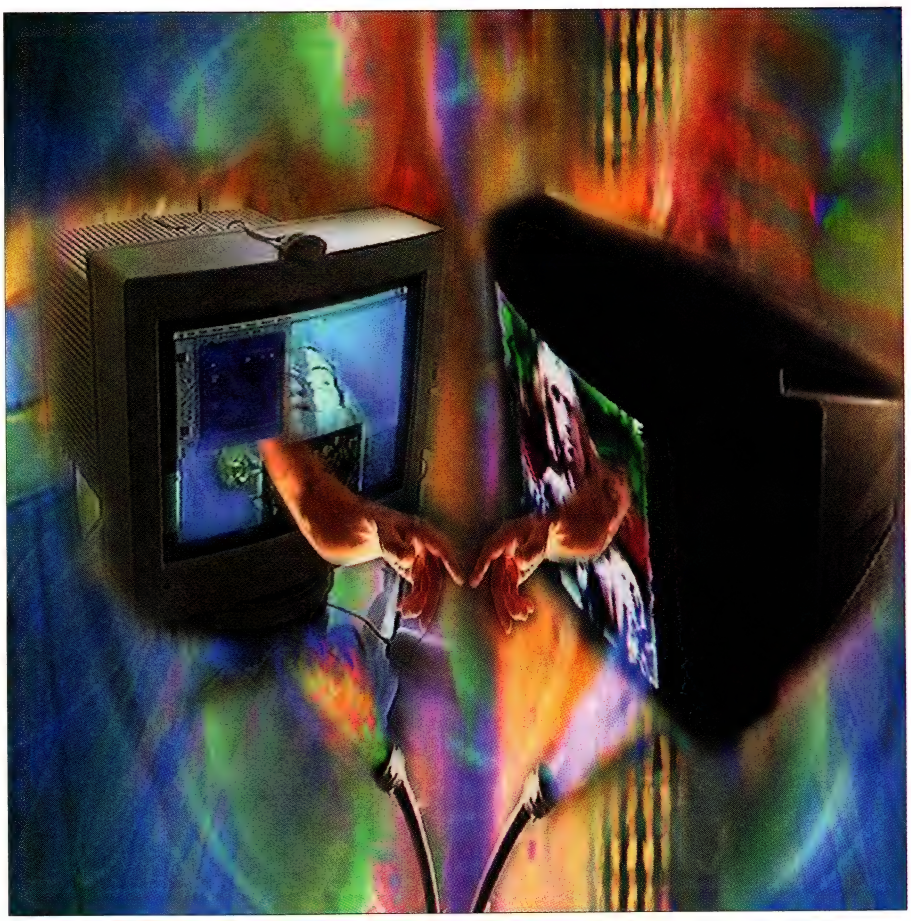
SMILE GERMANY
TEL : 49-2154-9280
FAX: 49-2154-1032

SMILE FRANCE
TEL : 33-1-49-842202
FAX: 33-1-49-842310

SMILE BENELUX
TEL : 31-10-2202313
FAX: 31-10-2200840

PC Weds TV

ADELE HARS



LANCE JACKSON © 1995

Cable TV systems may soon be a pipeline for more than just reruns, sports, and music videos

As PCs go multimedia and TVs go digital, their worlds are starting to overlap. While few people predict that they'll ever completely merge, cross-fertilization is already taking place. And that could mean good news for PC users and TV viewers alike.

Last year, much of the computer, cable TV (CATV), and telecommunications industries thought interactive TV would be the next big thing to storm living rooms of the world. Millions are currently being spent on high-profile test trials.

In Europe, telcos such as British Telecom, Deutsche Telecom, France Telecom, Belgacom, and Telia (Sweden), and computer companies such as IBM, Digital Equipment, Apple, Olivetti, Silicon Graphics, Hewlett-Packard, Oracle, and, of course, Microsoft, are involved in the tests. The trials essentially strip down a computer and turn it into a set-top box (literally, a box that sits on top of your TV) that is capable of handling interactivity for the TV over the cable network.

But trial after trial is showing that, for a vast majority of people, the TV is something that you flop down in front of at the end of the day with your favorite beverage in one hand and remote control in the other. Channel surfing, yes. More than that? Rarely. (People's attitudes aren't the only issue, though. There are problems of presentation. Text on the TV screen is very low definition, and remote-control devices can severely limit the friendliness of navigation.)

Now, some of the pioneers are turning their attention to PC users. Since they can get all that digital data into our living rooms via the CATV network—or at least they're working on it—why not channel it to the PC? Why not skip the TV altogether?

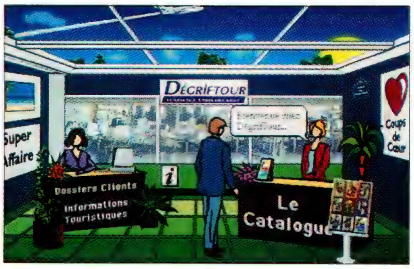
What Must Happen

For interactive services over CATV networks to become a reality, changes are needed in two areas: legislation and technology. Europe's cable operators are allowed to offer two-way interactive services only in France, Finland, the Netherlands, Sweden, and the U.K. The European Commission is currently circulating a draft of a directive among the EC member states to liberalize this and related issues in 1996, well prior to the full telecom deregulation that is planned for 1998.

Until then, according to the Yankee Group Europe's report "Cable TV in Europe: Selling More Than Channels," the "same fragmentation and regulatory constraints which inhibit cable telephony will also impede the industry's efforts to deploy advanced interactive and information services."

Two of the most important issues are availability and infrastructure—how many people can get the service and how it's piped into their home. Looked at this way, Europe's CATV markets fall into two groups:

- those places with high penetration of households but limited



Lyonnaise Communications and France Telecom are testing Multicable, delivered to a PC over the CATV network. The home page (left) is a virtual village, where you can click on images of banks, stores, cinemas, museums, travel agencies (above), and so forth to access high-bandwidth consumer services.

ability to support high-bandwidth services without a substantial upgrade to the infrastructure (these tend to be the countries that adopted CATV early on, such as the Netherlands, Benelux, Switzerland, and the Nordic countries);

• those places with low penetration but networks that are more capable of offering interactive services with little additional upgrading (Germany, France, the U.K., and potentially Spain and Italy).

Overall, 40 percent of European homes are "passed," meaning that the physical cable passes by their property line so that the residents could subscribe if they wanted. Eastern Europe is well served by a growing number of new cable networks. However, in some other countries, such as Italy, Greece, and Spain, there is virtually no cable service at all.

Those areas falling into the high-penetration/limited bandwidth category tend to have older, copper-based systems in a tree-branch network topology, which prohibits the possibility of interactivity without substantial upgrades and a virtual network overlay. They would need to upgrade the copper to hybrid fiber coax (HFC). Not a cheap fix. Of course, they don't have the problem of attracting subscribers, as they already have high penetration rates (e.g., 92 percent of all Belgian households subscribe).

The second group of households has relatively new installations using coax or HFC, often in a star topology that can handle interactivity. For them to enter the interactive services market, the big missing ingredient has been low-cost modems specially adapted for the megabits-per-second data speeds that a cable network can offer. These are now starting to hit the market, with products from companies such as Zenith, Intel, Motorola, Sagem, LanCity, and others.

"Cable TV operators now have the opportunity to establish a leading position in the competitive local-loop market of the future," says Paul Knott of Analysis, a consulting firm in Cambridge, U.K. The relatively low cost of converting existing coax cable networks to an HFC architecture will allow them to provide full interactive services economically, he says.

Meanwhile, the traditional telecom operators may be forced to invest in expensive fiber solutions if they are to offer an equivalent service. "Cable TV operators who already have coax and ducts in the ground can upgrade their networks to HFC in stages, limiting the investment needed at each stage," Knott says.

Multicable Turns On in Paris

Cable subscribers in Paris will be the first in Europe to get broadband, interactive PC services over the CATV network, and they may indeed be the first in the world to participate in a trial of the scope planned under the Multicable project.

Multicable provides on-line, broadband commercial services, including full Internet access for PC users at 1.5 Mbps over the CATV network. Because there is so much bandwidth available, the interface is heavily graphical and may even include video clips and sound. The home page features a virtual village, where you can click

More Signs of Convergence

More than 60 companies worldwide, including network operators (such as five major European telcos), systems integrators (including Alcatel and Olivetti), OEMs, and interactive content providers (e.g., Time Warner) are participating in Microsoft's Insight program for interactive television.

• More than 10 companies are currently offering low-cost modems for use over cable TV networks; a year ago there were virtually none.

• Major U.S. players, including Hearst Publishing, Time Warner, and Tele-Communications Inc. (TCI), are planning cable TV network-based Internet access for millions of U.S. subscribers next year.

• An n-tv/Apple/Oracle joint venture aims to bring "information on demand" to business desktop PCs in Germany.

• CableLabs, a consortium of U.S. cable TV operators, has issued an international request for proposals "for hardware, software, and operational support that would allow cable operators to deliver high-speed data services over a hybrid fiber/coax cable network."

• Computer giants such as IBM, Compaq, Digital Equipment, Intel, Bay Networks,and Northern Telecom have joined the CableLabs/IT Convergence Forum.

• Children visiting the "TV at the Crossroads" exhibition sponsored by Philips at the Pompidou Center in Paris assumed that the TVs on display had interactive touchscreens. They didn't. The children became quickly bored.

• Digital is providing the video server for interactive TV trials in Sweden. Apple is providing the set-top boxes for test trials by British Telecom, Telia, and Belgacom. Time Warner's Full Service Network trial in Orlando, Florida, uses a stripped-down SGI Indy as a set-top box.

• The Belgian government plans to allow cable operators to offer on-line information, games, and other interactive services beginning next year. This liberalization is prompted by similar reforms proposed by the European Commission draft directive.

• In Italy, the minister of the post and telecommunications, Agostino Gambino, is pushing for policy changes that would allow CATV operators to offer interactive services starting in 1996. Telecom Italia has indicated interest in offering interactive services over the optical-fiber cable network it plans to deploy to 10 million houses in 1998.

The Hardlock software protection system.

Universal and individual.

Across the world, there are currently over 1.5 million Hardlocks in use. They are all virtually hackproof, daisy-chainable, individually interchangeable, compatible, and with an almost incredible variety of forms and features, they are fast and easy to implement.

Want to know more? Want to find out which Hardlock will suit your application? Want to order the FREE Hardlock evaluation pack? No problem! Just dial...

MICROSOFT WINDOWS COMPATIBLE

yes It runs with NetWare®

Available and Ready for OS/2

CE 93

BeNeLux, Crypsys Data Security, Tel: ++31-1830-24444, Fax: ++31-1830-22848 · **Croatia,** G&G Electronic, Tel: ++385-41-315794, Fax: ++385-41-333510 ▲**Finland,** FAST Finland Oy, Tel: ++358-0-5611001, Fax: ++358-0-5611006 · ▲**France,** FAST Technologies, Tel: ++33-1-46211840, Fax: ++33-1-46210882 ▲**Great Britain,** FAST Electronic UK Ltd, Tel: ++44-1-71-2218024, Fax: ++44-1-71-7923449 · ▲**Greece,** FAST Hellas AE, Tel: ++30-1-6854623, Fax: ++30-1-6854624 · **Hungary,** Recognita Corp., Tel: ++361-201-8925, Fax: ++361-201-7607 · **Iran,** SinaSoft Co. Ltd, Tel: ++98-21-622986, Fax: ++98-21-8865588 · **Italy,** Techne S.r.l., Tel: ++39-59-440690, Fax: ++39-59-440720 · ▲**Spain/Portugal,** FAST Iberica S.L., Tel: ++34-1-7253626, Fax: ++34-1-7267219 · **USA/Canada/Far East,** Glenco Engineering Inc., Tel: ++1-708-808-0300, Fax: ++1-708-808-0313

Please contact FAST Electronic GmbH if your country is not listed.
Fast Electronic GmbH · Kaiser-Ludwig-Platz 5 · D-80336 Munich
Tel: ++49-89-53 98 00-20 · Fax: ++49-89-53 98 00-40

Circle 511 on Inquiry Card (RESELLERS: 512.

FAST Fast Electronic GmbH

on images to access consumer services (see the screen on page 48IS 6). And while one family member is on-line with the PC over the cable network, another can be watching shows on cable channels without any interference.

A major criticism of many interactive TV trials has been that they don't offer compelling new content or services. Multicable hopes to avoid this pitfall by having more than 50 well-known retailers, banks, travel services, museums, restaurant guides, and publishers participate.

Multicable was conceived by the country's largest cable operator, Lyonnaise Communications (LC), with the funding and participation of France Telecom. Pierre Bouriez, LC's development manager, is overseeing the project. In the beginning, he says, the company considered both the PC and the TV with set-top box as possible targets; however, further study revealed that less than 1 percent of TV viewers were willing to do something interactive with their TV.

On the other hand, the percentage of LC's cable subscribers with personal computers had almost doubled in a year to more than 40 percent, half of them with modems. For fully interactive services, the PC was clearly the way to go. Technical and commercial trials are currently under way, available to an initial 10,000 subscribers. LC plans a full rollout to the rest of Paris (more than 180,000 subscribers in all) in early 1996.

The initial monthly pricing for cable subscribers is expected to be 50 francs to 70 francs (US $10-$14) for the basic Multicable service, plus 150 francs (about $30) for unlimited 1.5-Mbps Internet access. LC will offer Web-compatible interface software and a modem rental. The system will use a cable-modem, called the CablePort, from Intel.

Web surfers from outside of France might be able to access some of the services, too, and small businesses might eventually be targeted, but those details are yet to be determined.

Learning from Each Other

There's a lot that the colliding worlds of the PC and the TV can learn from each other, says Stephen Heppler, director of the Ultralab Research Center at Anglia Polytechnic University in the U.K. He's working with BT, Apple, and the BBC on interface issues for BT's interactive TV trials. (His full report is available at http://www.ultralab.anglia.ac.uk/).

"People expect convergence," Heppler contends. The PC offers more possibilities for collaboration, but so far the TV wins out when it comes to quality narrative and content. Heppler says he'd like to see a "learning layer" incorporated into interactivity so that people can annotate what they see and hear.

Kids have become "information grazers," Heppler says. But he's concerned that, while some trials are indicating that people won't pay for interactivity, today's Nintendo players will expect it when they come of age. Heppler says he hopes investors won't back away. What is needed now, Heppler says, is a "leap of faith."

He's reminded of another time when the naysayers were wrong. In 1937, an editorial in the *New York Times* claimed that TV would never catch on because people just wouldn't have time to sit around and watch it. ■

Adele Hars is a correspondent for BYTE in Paris. She is also a technology writer for the GEID Press Agency, covering everything from semiconductors to telecommunications. You can reach her by E-mail at 100325.3703@compuserve.com.

Diving into C++ Database Development Without Velocis Can Be Pretty Ugly.

Velocis™ database server is a scalable high performance, client/server database engine that supports ANSI SQL, ODBC, C, and C++. Built to support complex database designs, Velocis provides powerful transaction processing features, low-level access, and portability. With multiple APIs, you have the power to build winning applications that can access the server from heterogeneous clients.

Raima Object Manager™ is a class library that encapsulates object storage and database navigation into C++ class definitions to provide a consistent, object-oriented interface to Velocis.

Combined, Raima Object Manager and Velocis provide the most comprehensive feature set available for your C++ database development.

RAIMA™

Call: 1-206-557-0200 Fax: 206-557-5200

Available for: Windows, Windows NT, OS/2, SCO, AIX, HP/UX, Solaris, Netware, and others

Raima Corporation, 1605 NW Sammamish Rd., Issaquah, WA 98027, Inside the US: 1-800-275-4724, Internet: sales@raima.com

Germany: 49 7022 9256 0 **Spain:** 3 43 485 13 04 **Italy:** 39 49 80 7 7 140 **Argentina:** 54 1 954 1414 **Raima UK Ltd.:** 44 1 273 819 292
France: 33 1 30 67 29 63 **Australia:** 61 2 419 7177 **Raima Benelux:** 31 2159 44 738 **Denmark:** 45 44 88 99 00
Taiwan: 886 2 503 3006 **Finland:** 358 0 8045 130 **Norway:** 47 22 110 950 **Sweden:** 46 13 111 588

Circle 521 on Inquiry Card (RESELLERS: 522).

Are you treating electricity like water down the drain?

You probably leave most of the printers, routers, bridges, hubs and other peripherals in your computer network running day in, day out — even if nobody is using them. That is a lot to pour down the drain each year.

Fiskars Power Systems has recognised the problem. That is why we are presenting the new PowerCheck, an intelligent network surge suppresser which automatically turns off office devices when they are not in use.

	United Kingdom	Germany	Switzer-land	Finland
Elec-tricity	£ 0.07 /kWh	DEM 0.30 /kWh	CHF 0.21 /kWh	FIM 0.40 /kWh
Office hours	10 hrs/day, 5 days/week	10 hrs/day, 5 days/week	10 hrs/day, 5 days/week	10 hrs/day, 5 days/week
Load	1 kVA	1 kVA	1 kVA	1 kVA
Savings per year	approx. £ 390 (= $ 628)	approx. DEM 1,600 (= $ 1,168)	approx. CHF 1,100 (= $ 965)	approx. FIM 2,000 (= $ 463)

Saves on the electricity bill

Switching devices on and off may not seem a big deal. But because PowerCheck is connectable to a Fiskars PowerServer UPS and LanSafe software, it has an added dimension as a valuable network power management tool.

When a PowerCheck controls a couple of network devices (about 1 kVA), it slashes almost 500 dollars off annual electricity costs. As up to 5 kVA can be managed through one PowerCheck unit, a quick calculation shows that you can save as much as 2,500 dollars a year, in some countries even more! And Power Check allows you to determine the rebooting order of the network. This ensures a secure log-in procedure — fully automatically.

Economy combined with environmental concern

PowerCheck saves energy and the invaluable natural resources by switching peripherals off when they are not being used. Can you think of any more efficient power-saving method? To top it all, each PowerCheck unit is manufactured to environmentally sound specifications.

So, not only does PowerCheck keep your energy bill under control, it helps you face your environment with a clean conscience.

And it is available from your nearest Fiskars authorised resellers at a very attractive price.

FISKARS

Fiskars Power Systems

P.O. Box 54, FIN-02921 Espoo, Finland. Phone +358 0 452661, fax +358 0 45266396, X.400: C=fi, A=mailnet, P=fps, S=sales

Circle 539 on Inquiry Card.

GREY MATTER

Prigg Meadow, Ashburton, Devon TQ13 7DF

Prices do not include VAT or other local taxes but do include delivery in mainland UK. Please check prices at time of order as ads are prepared some weeks before publication. This page lists some of our products – call us for a complete price list.

ORDER BY PHONE WITH YOUR CREDIT CARD

(01364) 654100

FAX: (01364) 654200

C & C++ FOR DOS

Comms

Async Prof for C/C++ 2.1	£170
Greenleaf CommLib 5.2	£235
MagnaComm/DOS	£215
SilverComm "C" Asynch 4.02	£195

Database

c-tree Plus 6.4b	£565
D-ISAM	£495
DataBoss 3.5 (Special Offer)	£79
SoftFocus Btree/ISAM	£75

Graphics

3D-Ware Prof	£249
Essential Graphics Toolkit	£320
Fastgraph 4.0 (Ted Gruber)	£195
GFX Graphics/Fonts & Menus	£330
GX Graphics 3.0	£155
GX Images	£399
MetaWINDOW-DOS 4.4	£170

GUI

Menuet/C 2.1	£300
MEWEL/GUI Std 4.0	£390
object-Menu w/Source 2.7	£510
Zinc Engine & DOS Key 4.1	£505

Math & Scientific

C/Math Toolchest & Grafix	£45
Huge Virtual Array & NAT 3.0	£215
Science, Eng & Graphics Tools	£115

Printer

BD/CX (DOS)	£300
BGI Printer Driver Toolkit	£105
GX Printer 1.5	£240
SLATE	£260

Screen

C-Scape 4.0	£419
C/Windows Toolchest	£45
Greenleaf Datawindows 3.0	£225
Panel Plus II 2.24	£260
TCXL UI Dev Sys for DOS/Win	£140

General & Systems Libraries

GX Sounds	£200
Interwork	£205
MTASK	£215
Multi-C w/Source	£39
TTSR Ram Res Dev Sys 2.0	£105
TSRs and More	£130

Tools

C-DOC 6.0	£175
C-Vision for C/C++ 4.0	£145
CC-Rider Deluxe	£465
Clear+ for C	£135
CodeCheck (Professional)	£475
PC-Lint for C/C++	£139
Source Print+ 5.1	£290

VISUAL BASIC FOR DOS

MS Visual Basic for DOS Std	£96
MS Visual Basic for DOS Prof	£230
NetPak Pro for DOS	£135
PDQComm	£79
QuickComm	£129
QuickNet	£79
RS232 Library	£130
db/Lib Prof 3.0	£195
VB/ISAM MU	£150
Graphics QuickScreen	£105
Graphics Workshop	£105
GraphPak Pro	£99
Compression Plus	£79
Compression Workshop	£110
PDQ	£110
Printer Plus	£130
ProBas 7.1	£210
QuickPak Prof 4.19	£145
QuickPak Scientific 3.0	£105
QuickScreen 4.0	£105

C & C++ COMPILERS

Borland C++ 4.5	£280
Borland C++ 4.5 & DB Tools	£405
Microsoft Visual C++ Intel Ed	£299
Salford C/C++ Win Developer	£395
Symantec C++ 7.0	£199
Turbo C++ for Win 4.5	£68
Watcom C/C++ 10.5	£239
Microsoft Visual C++ Std	£65
High C/C++ for Ext-DOS/Win	£620
Salford C/C++ DOS Developer	£195
TopSpeed C/C++ Prof	£215
Turbo C++ 3.0	£66

LOW PRICES FOR MICROSOFT & BORLAND PRODUCTS

Microsoft Access 2.0	**£289**
Microsoft Fortran 5.1	**£138**
Microsoft Fortran Power Station	**£230**
MS Macro Assembler 6.11	**£110**
MS Visual Basic for Win Std	**£96**
MS Visual Basic for Win Prof	**£230**
Microsoft Visual C++ 2.0	**£299**
Microsoft Windows 3.1	**£78**
Borland Database Engine	**£205**
Borland C++ 4.5	**£280**
Borland Pascal with Objects 7.0	**£250**
dBase 5.0 for DOS	**£405**
dBase 5.0 for Windows	**£280**
dBase Compiler 2.0	**£245**
Delphi	**£279**
Delphi Client/Server	**£806**
Turbo C++ 3.0	**£66**
Turbo C++ for Win 4.5	**£68**
Turbo Pascal 7.0	**£94**
Turbo Pascal for Windows 1.5	**£99**
Paradox for Win 5.0	**£280**

WITH FULL TECHNICAL SUPPORT

VISUAL BASIC FOR WINDOWS

Visual Basic 3.0 for Win Std	£96
Visual Basic 3.0 for Win Prof	£230
Comms Lib/Win	£115
Distinct TCP/IP - Visual Edition	£265
DsSocket 1.1 (Intro)	£65
NetWare Client SDK for VB	£169
Network Library/Win 1.1	£80
PDQComm for Windows 2.1	£79
ADE/VBX	£350
CodeBasic 5.1	£140
Controls for Btrieve	£185
Crystal Reports Pro 4.0	£290
Data Widgets	£99
DataDirect Multilink/VB	£255
Grid/VBX	£75
Integra VDB/VB, Desktop	£209
List & Labels for VB	£279
TrueGrid Pro 2.1	£90
VB/ISAM MU	£150
VB/Link for Lotus Notes	£715
VBtrv for Windows	£185
Visual/db Network 3.0	£235
AccuSoft Image Lib/VBX 5.0	£382
Image SDK Plus/VBX 2.0	£250
ImageKnife/VBX 2.0	£200
ImageMan/VB 3.0c	£239
ImageStream/VBX	£120
JPEG Image Compressor VBX	£169
LEADTOOLS VB 5.0	£425
PCX Toolkit for Windows	£155
3-D Widgets	£89
Calendar Widgets	£99
Chart FX 3.0	£225
Custom Control Factory	£49
Dazzle Prof 2.0	£420
Designer Widgets	£99
First Impression	£120
Formula One 2.0	£120
Gantt/VBX	£195
HighEdit 3.0	£199
MS Visual Control Pack	£69
Real-Time Graphics Tools - VB	£300
QuickPak Pro for Win 3.5	£145
Spread/VBX	£171
SpyWorks-VB	£120
TAB/PRO	£75
TList	£120
TX Text-Control Standard	£180
VB/Magic Controls	£120
VBAssist 3.5	£140
VBGraphix	£270
VBTools 4.0	£115
VB/Rig Professional	£79
VBX Artist	£240
WinWidgets/VBX	£160
3D Graphics Tools 4.0	£130
Code.Print Pro for VB	£85
Compression Plus 4.0	£175
d-Barcode VBX/DLL	£94
DynaZIP VBX 2.0	£129
FXTools/VB Std 1.5	£149
MediaKnife/VBX	£290
Microhelp Muscle/Win	£125
QuickPak Scientific for Win	£105
TMS Tools 1.1	£99
VB Compress	£99
VB Language Manager	£130
VB/DLL 1.0	£165
VERSIONS/VB 1.1	£135
Visual Developer's Suite	£216
Visual CAD Dev Kit	£520
Visual Instrument Panel Controls	£150
VisualSpeller	£120
VisualWriter Pro	£145
VSView	£105

C & C++ FOR WINDOWS

Asynch Pro for Win	£135
COMM-DRV/LIB	£140
Greenleaf Comm++	£180
Greenleaf CommLib Pro	£365
Borland Database Engine 2.0	£205
CodeBase 5.1	£248
CodeServer 5.1 (10-Clients)	£370
CXBase Pro	£500
DataBoss for Windows	£410
DataDirect Developer's Toolkit	£450
DataTable 2.5	£145
DBTools.h++ for ODBC	£340
Greenleaf Database Library 4.0	£180
Integra VDB/C++, Desktop	£209
List & Labels for Win (Pro)	£395
POET Personal SDK 3.0	£169
Raima Database Manager	£380
Spread/VBX++	£171
Velocis	£340
Charting Tools for Win 2.0	£180
Essential Chart for Win	£320[2]
GraphiC/Win 7.0	£360
Graphics Server 4.0	£245
Real-Time Graphics Tools	£360
AccuSoft Image Lib/Win 5.0	£610
AccuSoft Pro Imaging Toolkit	£610
Ad Oculos (Image Analysis) 2.0	£325
ImageMan	£399
LEADTOOLS Prof 5.0	£675
PCX Toolkit for Windows	£155
Borland Visual Solutions Pack	£59
Control Palette 2.0	£135
Crusher! Win DLL w/Source	£235
Diamond Toolkit	£310
Greenleaf ArchiveLib	£210
HeapAgent	£420
KPWin++	£600
Lapack.h++ w/source	£675
M.4	£660
Math.h++ 4.1	£340
Money.h++	£340
MS Visual Control Pack	£69
PKWare Data Comp Lib for Win	£175
ProtoGen+	£190
RWCanvas.h++	£340
SOMobjects Dev Toolkit	£220
TCOMP/Multi-Platform	£105
TG-CAD Prof 5.0	£795
Tools.h++ 6.1	£340
Visual Parse++	£289
WinMaker Pro 6.0	£725
WinWidgets++	£240
Zinc 4.1 for Windows & NT	£505

BASIC LANGUAGE

CA-Realizer 2.0 (OS2&Win)	£179
GFA-BASIC for Windows	£80
GFA-BASIC for Win Compiler	£54
PowerBASIC Pro (Win&DOS)	£210
BBC BASIC-86 Plus	£75
GFA-BASIC for DOS	£80
PowerBASIC 3.1 (DOS)	£109
TrueBASIC Std 3.0	£88

News & Views

Watcom C/C++ 10.5

A new version of Watcom's C/C++ compiler is always an event, and their latest 10.5 removes the last "buts" which may have put you off using it in the past. Major new features include:

- **Visual Programmer** by Blue Sky, visual design tool with functional preview mode, generates 16/32-bit MFC code
- **Windows 95 Ready**, supports pre-release version, free upgrade to 10.6 with full support
- **Improved Microsoft Compatibility** for easier porting of existing apps (MFC 2.5 & 3.0 included)
- **Technical Resource Database** on CD with technical tips & reference data
- **Competitive Upgrade only £139** from Visual C++ 1.5+, Borland C++ 4.0+, Borland C++ for OS/2 1.0+, Symantec C++ Prof 6.0+, IBM C Set++ 1.0+

If you are serious about C++, you should check out **Watcom C/C++ 10.5** - it's their best one yet.

DB2/2 Version 2

In 1983 IBM released DB2, one of the first Relational DBMS's. Now, 12 years later, they have released Version 2. It is the largest database release IBM has ever shipped, and is one of the most advanced databases available on PC's. Look at these new features:

- **Object Oriented Extensions** based on SQL3
- **Large Objects (LOBs)** maintained directly in the database
- **User-Defined Types (UDTs)** can be used for columns
- **User-Defined Functions (UDFs)** treated like built-in functions
- **Triggers** including statement & row, before & after, with two-phase commit processing
- **Constraints** let you restrict values to a given domain
- **Recursive SQL Queries** including path expression queries
- **Symmetrical Multi-Processing** right out of the box
- **Visual Explain** reports the query optimiser's execution plans, allows "what-if" analysis

The combination of LOBs, UDTs & UDFs lets you create function libraries that extend the functionality of the database. IBM are developing relational extenders for text, image, audio, video & fingerprint information.

DB/2 V2 is available now on OS/2, with a version for Windows NT due later this year. Call us for full details.

DELPHI

Delphi	£279
Delphi Client/Server	£806
Apiary Dev Suite for NetWare	£195
Conversion Assistant VB Std	£77
Eschalon Power Controls	£105
InfoPower (intro)	£140
Mobius Business Builder (Intro)	£199
Mobius Draw Kit	£99
Mobius WinG Sprite Kit	£99
Orpheus	£135
Real-Time Graphics Tools for Win	£360
VisualPro 1 - App Enhancement	£69
VisualPro 2 - Visual Video Pack	£99

PROGRAMMING tools

Ada	Assemblers
Basic	C/C++
Comms	Cross Dev
Custom Controls	Database
Debuggers	Dos Extenders
Editors	Fortran
Graphics	GUI
Linkers/Locaters	Lisp
Modula-2	Multi-tasking
Pascal	Prolog
Smalltalk	SQL
Version Control	Visual Programming
Windows	Xbase

We stock many items for which there is no space in these advertisements.

0895/cs

Circle 513 on Inquiry Card.

The ISDN LAN Connection

ELKE GRONERT

DON ARDAY © 1995

ISDN may soon be your company's internetworking medium of choice

If your company has several branches spread across central Europe, ISDN could be its best internetworking medium. As carriers in Germany, the U.K., France, and Denmark are able to satisfy demand, ISDN is taking off as a versatile intercorporate communications vehicle.

Modern ISDN routers allow for "enterprise links," which couple small and medium LANs to a WAN, and for "branch links," which connect several small LANs to a central site. Last year, about 5 million B-channels had been sold in Europe; more than 2 million were sold in Germany. This year, the market-research firm Dataquest expects a 50 percent increase over last year's numbers.

The rapid growth of B-channels has a strong impact on the LAN internetworking market. Sales of ISDN internetworking units in Europe have tripled from 14,200 in 1993 to 44,400 in 1994. Germany and the U.K. are leading this market with more than 15,000 units sold in each country in 1994.

Three Flavors of ISDN

There are basically three different types of ISDN internetworking products on the market today: stand-alone devices, software multiprotocol routers (MPRs), and standard LAN routers with ISDN capabilities. All router types allow ISDN access from a client LAN PC without additional equipment.

A stand-alone device is a dedicated box that accesses the ISDN network from a LAN. It can support between 2 and 32 Basic Rate Interfaces (BRIs) in one chassis and often provides features like point-to-multipoint connections that are important for larger corporations. A stand-alone device interoperates with any LAN OS. These products link directly to an Ethernet or Token Ring LAN and, therefore, are often easier to install and maintain than combined LAN/ISDN routers. Products in this area come from BinTec, Ouest Standard Telematique, or 3Com Sonix.

MPRs for ISDN are NetWare loadable modules (NLMs) with a broad range of ISDN functions. Since 1993, such third-party software publishers as AVM, Loewe Iscom, G. Diehl ISDN, Dr. Materna, and Maxpro have developed these products based on Novell's MPR technology (see the figure "How ISDN Plugs In to NetWare" on page 48IS 12). They run on a NetWare server or on a dedicated communications server for ISDN and work on top of an ISDN adapter board with typically one to four BRIs or one Primary Rate Interface (PRI).

Novell's MPRs add WAN capabilities to the NetWare environment. Though it does not directly support ISDN, it offers an interface for third-party developers to access the NetWare protocol stacks. Open Data-Link Interface (ODI), Call Control Agent (CCA), and hardware-specific drivers enable the MPR to treat data from a WAN the way it treats data from a LAN.

The products based on the MPR version 2.0 had some restrictions, including limited support of protocols and spoofing algorithms. But Novell added advanced WAN functions to version 3.0 that enable third-party developers to improve the ISDN internetworking qualities of their products.

Another restraint comes from the fact that a standard ISA/EISA PC Server has space for not more than four plug-in boards. Thus, the hardware limits the number of available BRIs for these

COMPUTER Quick

Multimedia

SoundBlaster 32 AWE Value Edition .. 235
Macromedia Director Studio 1375
Proxima Ovation 820 Active Matrix .. 4340
Radius VideoVision Studio 3790
RealMagic MPEG Producer 3600
Turtle Beach Multisound Monterey ... 335
TrueVision Targa 2000 EISA 4400

International Orders our Specialty

Backup

Colorado 700 MB Internal 275
Exabyte 4200C 4GB Int/Ext 940/1105
Exabyte 8505 8MM 10GB Tape Int .. 2099
HP DAT 3.5" 2/4/8-16GB .. 825/940/1160
WangDat 2/4G DAT 868
WangDat 4/8G DAT 1057

CAD

Autodesk 3D Studio Rel 4 ..... CALL
Calcomp 12x12 Cordless 295
Calcomp 12x18 Cordless 600
Calcomp CM Thermal A-B Size 6715
Calcomp DM A-D Size 1MB 8Pen 2250
Numonic Accu/Gnd 20x24 1525
SummaSketch III 12x12 334
SummaSketch MicroGrid III 44x60 .. 2970

Chips

All Upgrades -- AST, Apple, Compac, DEC, HP, IBM Silicon Graphics, SUN, Toshiba

CPU (Intel, Cyrix, AMD-DX2, DX4) .... CALL
SIMM - ALL CONFIGURATIONS ..... CALL

Hard Drives

CALL for today's price!

Conner /Maxtor 540MB IDE 180
Conner/Quantum 1GB SCSI 370
Conner 1.2G IDE 3.5" 260
Conner 2.1 GB SCSI 3.5" 710
Micropolis 1.6GB AV 3.5" IDE 600
Micropolis 9GB SCSI 5.25" 2500
Seagate 2.1GB Barracuda 1045
Seagate 15150N 4.2GB SCSI 1655

Computers

pentium™ PROCESSOR

DEC ALPHA PC 150Mhz 17" Monit ... 7308
ALR Revol Q-SMP EISA 100Mhz 6625
ALR Revol PCI/EISA 100Mhz 4565
Intel MB Pentium+8MB EDO Mem 645
AIR Dual Pentium MB EISA/PCI 810

Controllers

Adaptec 2742WK Wide EISA Kit 389
Adaptec 1542CF Kit 265
Adaptec 2742A EISA SCSI 327
Adaptec 2842C VLB SCSI 296
Buslogic KT946C SCSI PCI Kit 295
QLogic FastSCSI PCI 205
QLogic FastSCSI EISA/PCI 204

Graphics Cards

ATI Gr Ultra Pro TURBO 4MB VLB/PCI 501
Diam Video Star Pro 495
Diam Stealth 64 4MB VLB/PCI 472
Diam Viper 2MB VLB/PCI 314/330
Matrox MGA Impress Pro 8.5MB 1425
Matrox MGA Impress+ 2MB PCI/VLB . 375
Number 9 Image 128 Bit 4MB PCI 875
Number 9 GXE 64 Pro 64 4M PCI 698
Number 9 771 Motion 4MB PCI 450
Orchid Kelvin 2 MB 64-bit VLB 224

• Quantity Discounts
• Dealer Discounts

Modems/FAX

BOCA 14.4/14.4 Int/Ext 87/112
BOCA VFAST 28.8 V.34 Int/Ext ... 183/222
Hayes Optima 14.4/14.4 Int/Ext . 370/390
Hayes Optima 28.8V.34 430
Intel SatisFaxtion400 Int/Ext 280/320
Multitech 19.2 ZPX/ZDX 158
Multitech MT1932BL 403
SHIVA NET Modem WIN 1400
Supra 14.4/14.4 Int /Ext 80/92
Supra 28.8 V.34 Ext 199
USR Courier DS V.34 External 580
USR Sports 28.8 V.34 Int/Ext 219/245
Zyxel ALL MODELS ..... CALL

Network

Novell Netware 3.12/4.1/SFT ..... CALL
3COM Etherlink III 16Bit /Combo 105/135
3COM Tokenlink III 16/4 455
Cisco 4 Port Router V.35/X.21 1690
Gandalf ISDN-TA-1 RS232 Adapter 765
Intel EtherExpress Pro PCI 100 220
Intel EtherExpress FlashC 127
Intel EtherExpress 32 EISA 383
NE 2000 Compatible 35
NE 2000 Plus 100
NE 2000 Plus 5 Pack 450
NE 3210 EISA 195
SMC EtherEZ-C0/TP/Combo 110/107/125
SMC EtherPower PCI 10/100Mbit 175
Thos C Fiber Optic 16Bit 100Mbit 715
Thos C EISA Fiber Optic 599
PACK/20-PACK/50-PACK/100-PACK

OS

DOS 6.22 ..... CALL
OS/2 3.0 Warp CD-ROM 88
SCO UNIX OS MultiUser 840
SCO Open Server Enterp16user 1250
Windows 95 on CD-ROM 110
Windows 3.11 Upgrade 42
Windows NT 3.51 WorkStation 298
Windows NT 3.51 Server 640
Windows for WG Starter Kit 458

UNIX

Fox Base MultiUser 775
MS Word MultiUser 970
SCO UNIX Unlimited 1029
SCO NFS v1.2.1 450
TCP/IP Runtime Unlimited 450

CD-ROM/ Optical

Fujitsu Mag/Opt 128MB 3.5 Ext 892
NEC Triple Speed OEM SCSI Int 330
Toshiba Quad Speed SCSI Int 300
Plextor Quad Speed(4X)CD ROM Int .. 395
Pinnacle Recordable CD ROM Ext 1700
Pinnacle Optical 1.3GB 5.25 2790

30,000 Item Catalog Program with Current Prices
*
FREE with Order

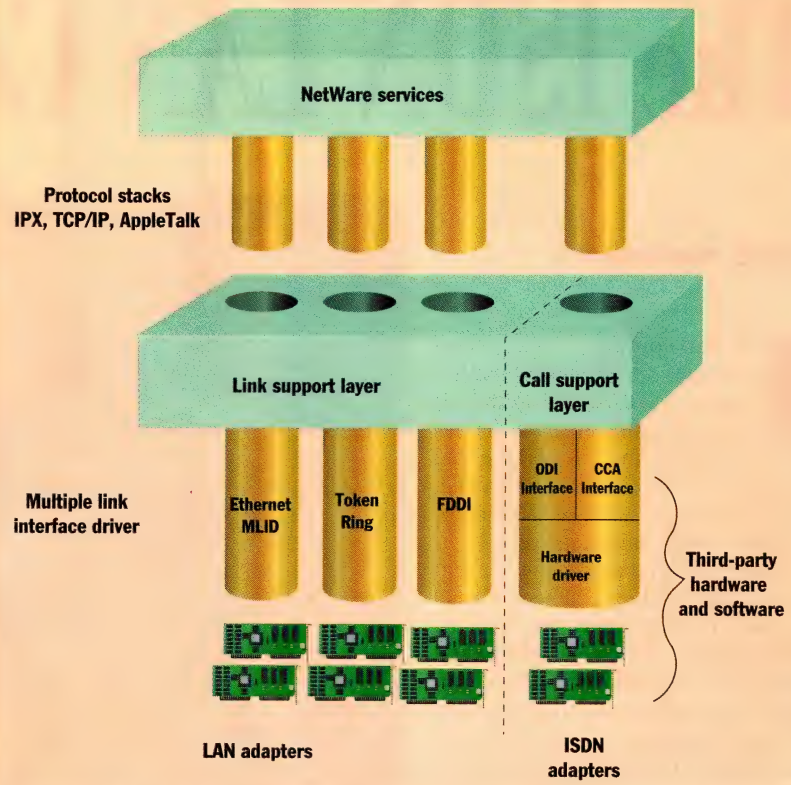
PHONE: (415) 861-8330
Español: (415) 861-8376
FAX: (415) 861-8380
E-Mail - CQK@AOL.COM
WWW.CQK.COM

Low freight rates •No handling charge •Prices are for cash prepayment •VISA/MC/AMEX accepted •Products may be USA versions •No returns on opened software •Prices are FOB USA & subject to change •15% restocking charge for non-defective returns

Computer Quick, 165 - 8th Street, No. 309
San Francisco, CA 94103, USA

Circle 505 on Inquiry Card.

How ISDN Plugs In to NetWare



Novell's MPR adds WAN capabilities to a NetWare environment. Though the MPR does not directly support ISDN, it offers an interface for third-party developers to access the NetWare protocol stacks.

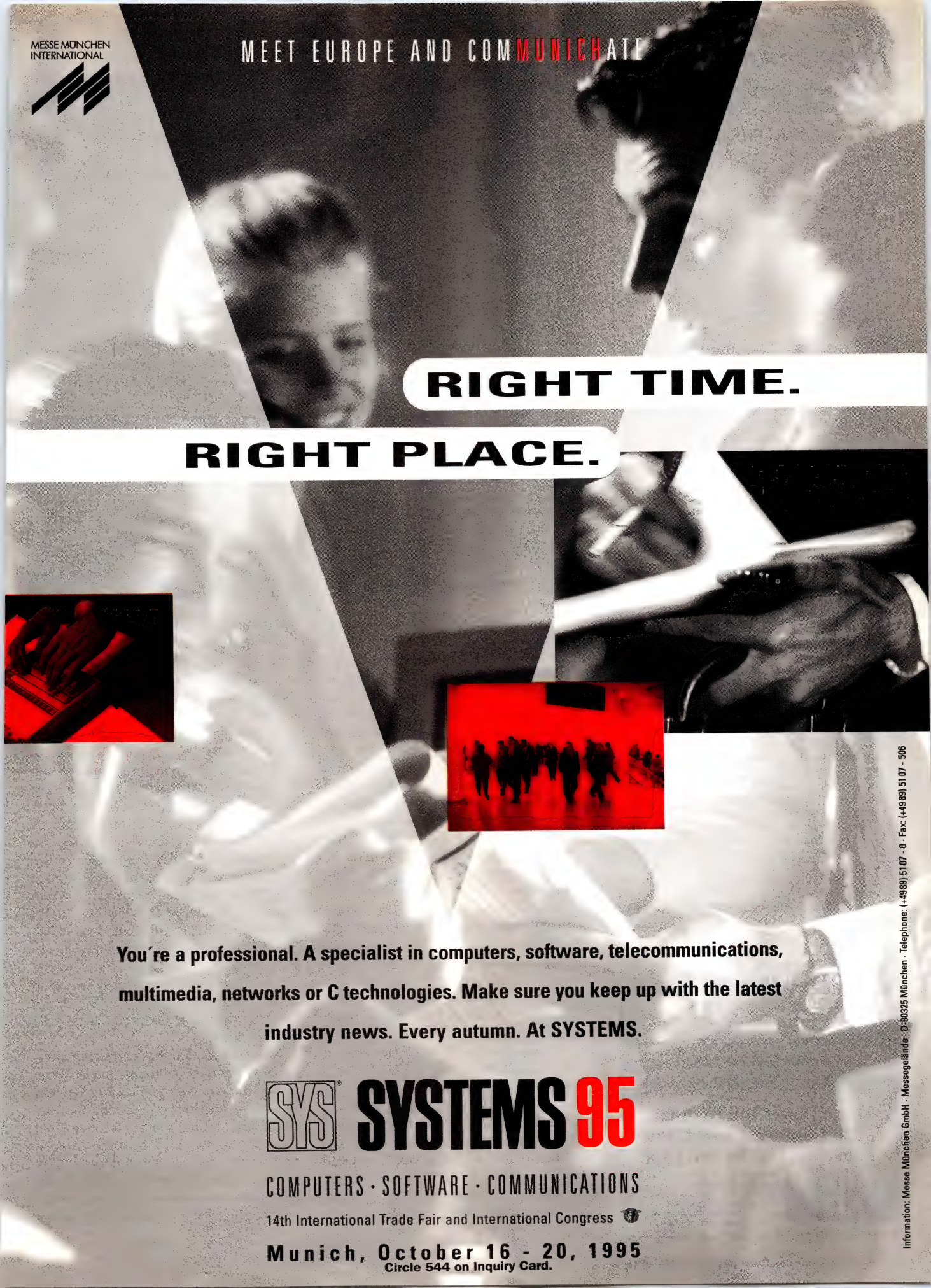
software solutions. To bypass this restriction, the latest MPR versions of AVM and ITK, for example, accept a combination of BRI and PRI boards in one server supporting a total of 60 AVM and 36 ITK B-channels.

Worth noting is that NLMs are usually hardware independent and interoperable, but the NetWare-based ISDN solutions aren't. Each ISDN implementation is expected to operate with only one proprietary ISDN controller. Few of the existing implementations interoperate with other NetWare-based or industry-standard ISDN communications platforms. The result is that users of NetWare-based ISDN implementations do not have the freedom to choose products of different vendors. The same is valid on the remote client side. If you want to be sure that products of different vendors interoperate, you have to buy the same system for the central and remote site or at least check the interoperability of different systems.

A solution for the lack of interoperability between remote and central sites is Point-to-Point Protocol (PPP). Today, PPP is mainly implemented in LAN/ISDN routers from Cisco, Bay Networks, or 3Com. PPP actually comprises a suite of protocols providing encapsulation, data-link control, data-link inverse multiplexing, link-quality monitoring, access authentication, data compression, network-layer configuration, and multiplexing. A key design goal for PPP was interoperability between systems of different performances and capabilities. PPP fixes minimal services to be provided by a router and defines optional services that can be negotiated between two routers. Each time a PPP connection is established, the two linked peers dynamically check a set of operational parameters supported by both sides.

Unfortunately, Novell's NetWare PPP depends on the ISDN boards' hardware drivers. Because there is no agreement among the ISDN board vendors regarding the hardware support for the PPP protocol suite, PPP services of MPR solutions are often reduced, and interoperabilty is not warranted.

The Multilink PPP Protocol plays a decisive role for channel bundling and aggregation of ISDN bandwidth, which is most important for large file transfers,


MESSE MÜNCHEN INTERNATIONAL
MEET EUROPE AND COMMUNICHATE
RIGHT TIME.
RIGHT PLACE.
You´re a professional. A specialist in computers, software, telecommunications, multimedia, networks or C technologies. Make sure you keep up with the latest industry news. Every autumn. At SYSTEMS.
SYS SYSTEMS 95
COMPUTERS · SOFTWARE · COMMUNICATIONS
14th International Trade Fair and International Congress
Munich, October 16 - 20, 1995
Circle 544 on Inquiry Card.
Information: Messe München GmbH · Messegelände · D-80325 München · Telephone: (+49 89) 51 07 - 0 · Fax: (+49 89) 51 07 - 506

Express Service to your door, low prices !

CD-ROM/Optical

Goldstar 2X Ide Int 119
Pinnacle Tahoe 230 optical 999
Pinnacle RCD1000 record/int 1775
Pli Quick Cdrom 15X 1079
Sony 4X Int Atapi/Scsi 229/309

Do-it-Yourself/Components

Chips/memory . . . . . call
Controllers . . . . . call
Ethernet/Token ring cards . . . . . call
Hard Drives . . . . . call
System boards . . . . . call
Video cards. . . . . call

Internet/Communication

Distinct Tcp/ip sdk visual/std/pro . 279/449/619
MKS Internet anywhere/5 user. 49/129
Mustang Wildcat BBS 1/10/48 user 89/169/329
Netmanage Chameleon/NFS 414/714
Netscape Navigator 39
Quarterdeck Webauthor for Word 99
Quarterdeck Webserver/Mosaic 114/29
Spry Internet in a box/Mosaic in box 99/29
Sun Pc Nfs base/1 user/5 user 72/229/1099

Call for products not listed we have 30,000+ references

Modems/Fax

Boca 14.4 w/fax internal/external. 86/112
Boca V.34 28.8 w/fax internal/ext 180/222
Hayes Optima 288 V.34 intern/ext 399/449
Supra Express 14.4 w/fax int/ext 89/104
Supra Faxmodem 28.8 V.34 int/ext . . . 189/214
Us Robotics Sportster SI 14.4 int/ext 79/94
Zoom Vfp 14.4 w/voicemail int/ext . . . 109/159

Software Development

Blue Sky Robohelp 439
Borland C++ 4.5/C++ OS/2 . . . . . 349/349
Borland Delphi compet upg/RAD 189/179
Borland Turbo C++ visual 79
B-trieve devlpt kit dos/win 419/419
Intersolv Q&E 459
Microsoft SQL server NT/upg 939/339
Microsoft Visual C++ 2.0/upg 389/239
Microsoft wind NT server/wkst 679/299
Microsoft SMGL author/word. 589
Microsoft source safe/upg 479/99
Novell. . . . . call
MKS toolkit dos+win/Lexx Yacc 199/199
Powersoft powerbuilder desktop/upg . . 499/189
Powersoft Funcky/Infomaker 209/209
Sheridan Vb Assist/data widgets 99/99
Watcom C++ 10.0/fortran 9.5. . . . . 189/349
Watcom SQL win/network server. 224/639

Tel: +1-415-325-8808
Fax: +1-415-325-1081
e-mail: mdintl@aol.com
Established 1984
Payment: Visa/MC or wire

Micro Direct International
220 California Ave #250
Palo Alto, CA 94306 USA

MDI

Prices fob USA. Prices subject to change without notice. Products may be US versions. Call for RMA. Restocking fees may apply. All trademarks property of their respective owners.

Important ISDN Router Features

- **Routed LAN protocols:** Most products support IP and IPX. Multiprotocol router (MPR)–based solutions usually offer a broader range of routed protocols such as SPX, NLSP for IPX, and OSPF for TCP/IP. They can also bridge the "nonroutable" protocols NetBIOS and SNA.
- **Number of supported BRIs:** Products that support one or two interfaces are appropriate for branch offices and small- and home-office users. If you expect your data traffic to increase during the life cycle of the product, you'd better look for products that support multiple Basic Rate Interfaces (BRIs) or Primary Rate Interfaces (PRIs).
- **Dynamic or static aggregation:** Static aggregation lets you define a number of aggregated B-channels for a certain link. Dynamic aggregation automatically adds new channels to ensure fast data transfer, but it also reduces bandwidth in case of low traffic, saving costs.
- **Support of Multilink PPP:** Multilink Point-to-Point Protocol (PPP) defines how to bundle bandwidth in a heterogeneous environment. Products that support this protocol make you more independent of the vendor. You're not tied to a single product type, so you can use different vendors' products at the central and remote sites.
- **Spoofing:** As LAN protocols are not developed for use in the WAN area, spoofing suppresses the LAN protocols' polling and reduces costs.
- **Short-hold mode:** Short-hold mode disconnects lines with no traffic but keeps the protocol information to quickly activate the link when new data is transmitted, saving costs.
- **Watchdog functions:** The router can calculate cost-efficient data transfer according to local tariffs.

especially when the 64 Kbps offered by a single B-channel is not enough. In this case, the router has to detect vast amounts of data to be sent and dynamically add more bandwidth. Multilink PPP will make this process transparent to different vendors' devices. Only a few vendors are currently supporting this protocol.

Aggregation can be dynamic, often referred to as "on demand," or static, where special applications and connections have a predefined bandwidth and the aggregated call is set up automatically. Static aggregation implies that the user has to pay for every aggregated B-channel, whether it is used or not.

Most of today's products are not able to bundle more than two B-channels. This limitation is due to the fact that most boards can't aggregate over multiple boards. Novell's MPR 3.0 lets you aggregate two ISDN channels in the Branch Link version and up to 16 in the Enterprise Link version.

If a central-site LAN needs to connect to only a small number of branch LANs, a point-to-point connection is all that is required. In this case, each B-channel can link to only one dedicated destination. Thus, the number of destinations is limited by the number of B-channels available. But some routers also offer point-to-multipoint connections. A point-to-multipoint–capable router can store hundreds of destination numbers in its routing table and call up each destination on any free channel. This feature is useful for big companies, which need to link to a lot of branch offices but can't afford a dedicated channel for each location.

Cutting Costs

Routers were originally designed to segment a LAN environment. To check the status of the connected devices, the router polls every 30 to 50 seconds (depending on the protocol). This technique makes sense for monitoring a LAN, but when it comes to linking remote sites over ISDN, each poll means additional connection costs to the user. To avoid these costs, ISDN routers use a technique called *spoofing*. The ISDN router then sends a message to a LAN router to pretend that the remote site is still active without actually setting up a call. Today, spoofing for SPX is a rare feature, whereas many products provide IPX spoofing.

Another function that saves communications costs is the short-hold mode. When one of the two communications devices detects no traffic for a certain time, say for 20 seconds, it disconnects the link but keeps the protocol information. As soon as new data arrives, it activates the link with the same protocol setup. This procedure saves costs not only because of the line interrupt but also because it does not

"If you need to share files between Windows NT and UNIX or another NFS system, these excellent products will do the job with a minimum of fuss."—
Open Systems Today 11/28/94

Four Great Products For Simple File And Disk Sharing Across Multiple Platforms.

Intergraph's full line of Windows NT and UNIX integration products makes it easy to cross platforms. Streamline client/server networks. And simplify every system manager's life.

PC-NFS for Windows NT. Lets Windows NT users access files and resources on UNIX servers and workstations. And connect to corporate databases and mail systems. From the familiar Windows interface.

DiskShare for Windows NT. Lets UNIX NFS users access files and directories on Windows NT servers and workstations. While taking advantage of UNIX utilities to manage files on Windows NT seats. With Windows point-and-click interface.

eXalt for Windows NT. Lets eXalt users move quickly between X-based applications and Windows NT. Without cumbersome text-file editing. Using a Microsoft Windows, Open Look, OSF/Motif or twm look-and-feel.

Batch Services for Windows NT. Lets Windows NT users schedule, manage and reschedule non-interactive jobs. Locally or network-wide. With the Windows interface.

Total Support. 100% Satisfaction Guaranteed. Like all Intergraph software, these integration applications come with the industry's top-ranked support. And a 30-day, 100% satisfaction guarantee.

For more information call:

U.S.	800-345-4856
Asia-Pacific	852-893-3621
Canada	800-461-5297
Europe	31-2503-66333
Middle East	971-4-367555
Other areas	1-205-730-5499

Internet: http://www.intergraph.com

INTERGRAPH®
SOFTWARE SOLUTIONS

SunSelect, the Sun logo, NFS and ONC are trademarks or registered trademarks of Sun Microsystems, Inc. Intergraph and the Intergraph logo are registered trademarks of Intergraph Corporation. Microsoft is a registered trademark and Windows, Windows NT, Windows 95, and the Windows logo are trademarks of Microsoft Corporation. Other brands and product names are trademarks of their respective owners. ©1995 Intergraph Corporation, Huntsville, AL 35894-0001.

MICROSOFT WINDOWS COMPATIBLE

Circle 518 on Inquiry Card (RESELLERS: 519).

Where To Find

Acotec
Berlin, Germany
+49 30 46706 0
fax: +49 30 46706 126

AVM
Berlin, Germany
+49 30 39976 0
fax: +49 30 39976 299

Bay Networks
Wiesbaden, Germany
+49 611 928 45-0
fax: +49 611 928 45-50

BinTec
Nuremberg, Germany
+49 911 9673 0
fax: +49 911 6880 725

Brand Communications
Cambridge, U.K.
+44 1223 232 319
fax: +44 1223 232 348

Cisco Systems
Munich, Germany
+49 89 32 1507-0
fax: 49 89 32 1507-10
http://www.cisco.com

Dr. Materna
Dortmund, Germany
+49 231 5599 0
fax: +49 231 5599 100

G. Diehl ISDN
Leonberg, Germany
+49 7152 9329 0
fax: +49 7152 932999

ITK
Dortmund, Germany
+49 231 9747 123
fax: +49 231 9747 111

Loewe Iscom
Berlin, Germany
+49 30 549 570
fax: +49 30 549 57244

Maxpro
Täby, Sweden
+46 8 732 8715
fax: +46 8 732 4692

NCPengineering
Nuremberg, Germany
+49 911 9968 0
fax: +49 911 9968 299

Ouest Standard Telematique
Cesson Sevigne Cedex, France
+33 99 86 8441
fax: +33 99 8684 13

Synaptel
Velizy Cedex, France
+33 1 306700
fax: +33 134653913

3Com Sonix
Cirencester, U.K.
+44 1285 641651
fax: +441285 642098

need to negotiate the protocol, which usually takes several seconds.

Many ISDN routers—software and stand-alone—feature watchdog functions. However, the actual implementations in the products are very different. Watchdog functions are sophisticated techniques to reduce connection costs.

Routers that include a more advanced watchdog function know the price and the duration of a basic connection unit. These devices are able to decide if it is cheaper to turn the line down or to hold it. For example, a data transmission might take 30 seconds, but if you have to pay for the time in 60-second increments, it is better to keep the line and wait for a possible second transmission within the remaining 30 seconds. If there is no data transmission during this period, the line will be disconnected, and the router will wait for another call to connect again.

A third category of watchdog functions includes application-specific knowledge. For example, if an application sends data every 3 minutes, the router is able to learn how to handle this kind of traffic as effectively as possible, considering connection costs and time units.

However, finding the lowest rates is not easy to implement. The variety of ISDN tariffs in different European countries makes it tough for a vendor to keep up with rate changes.

There are other important features such as automatic callback, filters to avoid redundant traffic, and management functions that offer monitoring and accounting information.

Most products in the ISDN internetworking area support NetWare. But if you plan to equip your LAN with Windows NT, look at products that come from companies such as Acotec, Brand Communications, NCPengineering, and Synaptel. ■

Elke Gronert is a freelance writer based in Munich. She specializes in telecommunications and networking. You can reach her on the Internet or BIX at editors@bix.com.

Build Your Own TCP/IP Applications

with Distinct TCP/IP DLLs and Custom Controls (VBXs)

SOFTWARE DEVELOPMENT KITS
Visual Edition

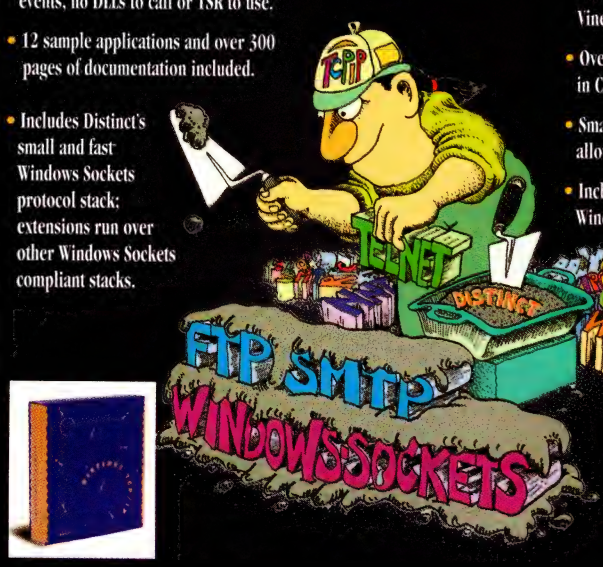
- TCP/IP Custom Controls for Windows Sockets, SLIP/PPP, Telnet, VT220, FTP, RCP, R-commands (remote shell, rlogin and rexec), Mail (SMTP, POP2/POP3) and News (NNTP). For Visual Basic users only.
- Just define properties and handle events, no DLLs to call or TSR to use.
- 12 sample applications and over 300 pages of documentation included.
- Includes Distinct's small and fast Windows Sockets protocol stack; extensions run over other Windows Sockets compliant stacks.

SOFTWARE DEVELOPMENT KITS
Professional Edition

- Includes all the features of the Standard Edition PLUS Telnet VT emulator, drag and drop FTP client and server, TFTP, LPR, LPD, transparent printing, Network Monitor, Finger and more.

SOFTWARE DEVELOPMENT KITS
Standard Edition

- APIs for Windows Sockets, Berkeley Sockets, ONC RPC/XDR, Telnet, FTP, SMTP, POP2/POP3, NNTP and NetWin.
- Supports NDIS, ODI or Packet drivers, SLIP, CSLIP and PPP with scripting.
- Co-exists with Windows for Workgroups, Netware, Lan Manager, Vines, Lantastic and Pathworks.
- Over 400 KB source code samples in C, C++, and Pascal.
- Small, fast and robust 100% DLLs, allow up to 128 concurrent sessions.
- Includes C++ Class Libraries for Windows Sockets, Telnet and FTP.



distinct
Email:mktg@distinct.com
http://www.distinct.com
Fastfacts: 408.366.2101
Fax: 408.366.0153
Phone: 408.366.8933

 Circle 533 on Inquiry Card (RESELLERS: 534).

The Road Less Traveled

PAUL VAN DE BRAAK

LYN BOYER-NELLES © 1995

Neural networks may help ease congestion on European roads

Stop-and-go traffic is fast becoming the norm on many of Europe's major highways. And the problem is getting worse, not better.

In Europe, some 120 million cars compete for a clear stretch of road each day. That number will increase to 140 million by the year 2000. New roads are expensive and cause environmental damage. Several European organizations are engaged in projects studying how to reduce traffic congestion using sophisticated traffic forecasting and management programs.

Telematics

"The key to smart mobility is intelligent traffic telematics," says Patrick Grillo, project officer of the European Commission's (EC's) Dedicated Road Infrastructure for Vehicle safety in Europe (DRIVE) II transport telematics project. The EC has marshaled the forces of telematics, a blend of information technology (IT) and telecommunications, to relieve Europe's congested road networks and increase the efficiency and safety of road transport.

The DRIVE program was initiated in 1988 by the EC. It consists of some research projects testing computer-assisted systems for route guidance, travel information, fleet management, and traffic forecasting and monitoring.

The Europeans are not alone in their telematics efforts. Several Japanese and U.S. firms are competing to be the first to supply Advanced Transport Telematics (ATT) applications. In Japan, 200,000 cars with navigation systems have already been sold. In America, a major R&D program has been launched with strong financial backing from the U.S. Congress.

ATT applications address such questions as: How can we use existing roads more efficiently? How can vehicles be guided to bypass accidents and other incidents that cause gridlock?

Monitoring Traffic

Several traffic-monitoring experiments are happening in major European cities. In France, automatic detection of traffic-stalling incidents is taking place on the Boulevard PeriphÇrique, the 35-kilometer orbital motorway around Paris, which accounts for 40 percent of the traffic of Paris, or 1,200,000 vehicles per day.

One field trial that's taking place in an interurban area is the General European Road Data Information Exchange Network (GERDIEN), developed in a project led by TNO, the Dutch Organization for Applied Scientific Research. The GERDIEN test site—the A12 and A20 motorways linking the Hague, Hoek van Holland, and Utrecht in the Netherlands—is one of the most populated parts of Europe. Traffic on the motorways in the project area covers 60,000 movements per day in each direction.

The Rhine/Main Area Project for Integrated Traffic management (RHAPIT) is an initiative of the German federal state of Hessen and part of an existing integrated traffic-control system in the Rhine/Main area. The core of RHAPIT is a knowledge-based traffic-information system called System of Cellular Radio for Traffic Efficiency and Safety (SOCRATES). SOCRATES uses bidirectional mobile radio communication over GSM/D1 for

Something Missing?

Complete your BYTE collection by ordering Back Issues today!

	1990	1991	1992	1993	1994	1995
January						
February						
March						
April						
May						
June						
July						
August						
September						
October						
November						
December						
Special Issues	IBM					

Rates (postage and handling included): Only credit cards or Eurochecks accepted!

Holland	**Dfl 20.00**	Switzerland	**SwFr 16.00**
United Kingdom	**£ 7.75**	France	**FFr 59.00**
West Germany	**DM 18.00**	Sweden	**SEK 80.00**

Please indicate which issues you would like by checking(√) the boxes. Send requests with payment to:

BYTE Back Issues, c/o Dynamic Graphics International, P.O. Box 25, 3950 AA Maarn, The Netherlands

☐ Check enclosed

Charge: ☐ MasterCard ☐ Eurocard ☐ VISA ☐ American Express

Card # _____

Exp. Date _____

Signature _____

Name _____

Address _____

Postcode _____ City _____

Country _____

All orders must be prepaid. Credit cards preferred.
Please allow three weeks for delivery by surface mail.

BYTE
Because the *Experts* decide.

route guidance, driver information, and emergency calls (see the figure "A Neural Network Studies Traffic Patterns").

The goal of these projects is to implement an on-line system for monitoring traffic and forecasting the traffic density during the next 30 minutes. An on-line forecasting system should enable a traffic operator to recognize changing traffic situations early and to modify traffic lights and message signs. It also should be capable of estimating travel times on a congested road and displaying congested roads as colored sections on the operator's screen.

Using Neural Networks

Because traffic flows are erratic, it's not easy to predict how clear or cluttered roads will be at any given time. Minor incidents (e.g., a flat tire) can tie up a motorway for several kilometers. Traffic is a complex process with several interdependent parameters. The only way to accurately forecast whether traffic will be heavy or light is to use the raw data detected by loop detectors. Neural networks are used to process and analyze the data.

Neural networks can derive estimations, predictions, and forecasts out of a given set of time series. As opposed to statistical approaches to forecasting, neural networks don't require an underlying prediction model.

The GERDIEN project deployed a back-propagation neural network that runs in an embedded environment with other traffic management applications. To construct the neural network, project members used the network-simulation package NeuralWorks Professional II Plus from NeuralWare (which is distributed in Europe by Scientific Computers, +44 1293 403636). NeuralWorks is capable of generating C++ code to integrate the network into any given environment.

The back-propagation model belongs to the group of supervised-learning, feed-forward networks, which adjust the internal network nodes from the known output information. Because the dynamic traffic-forecasting system of GERDIEN required on-line predictions, the feed-forward feature of back-propagation networks was necessary for this project.

A neural network consists of many nodes joined together by connections so that the outputs of the nodes are inputs to others. The nodes are the basic building blocks of the neural network. A node takes in a set of inputs and computes the output according to a transfer function.

The output state of a single node is characterized as either on or off. A change

INTELLIGENT TRAFFIC TELEMATICS

Intelligent traffic telematics comprise sophisticated services for

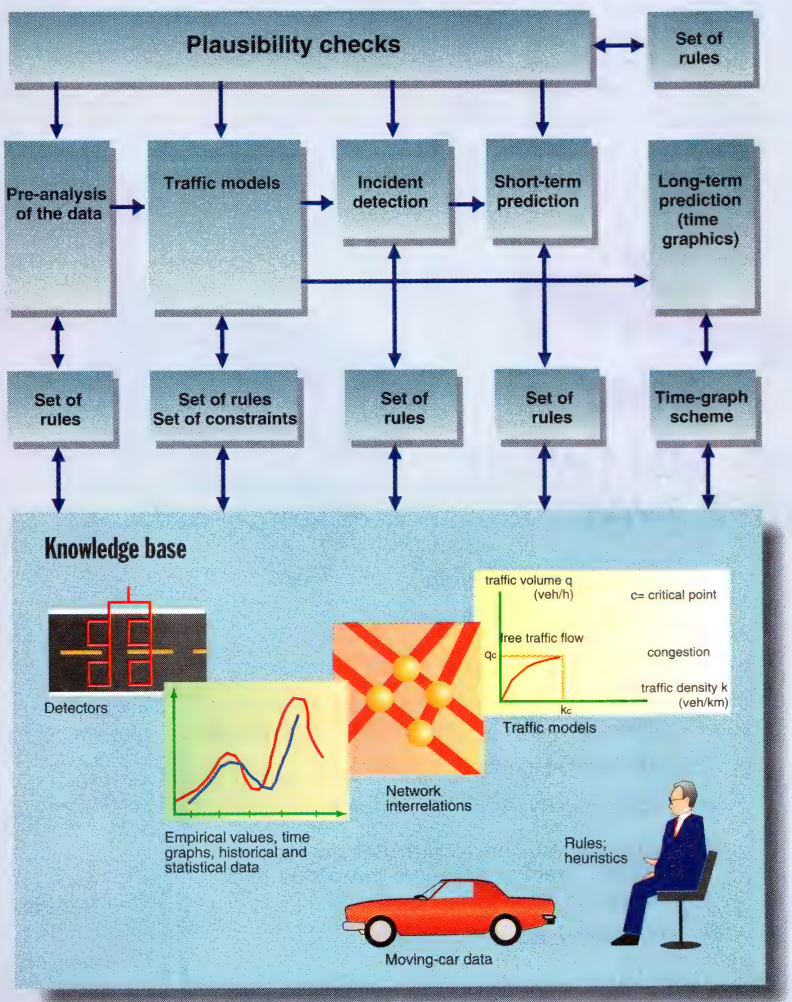
- Dynamic traffic forecasting
- Dynamic route guidance
- Trip travel information
- Parking and public transport information
- Emergency services for vehicles
- Early warning of dangerous road conditions
- Fleet management and automatic vehicle location

from one state to the other is triggered when the sum of the inputs (weighted by the strength of their respective connections) passes a threshold, represented by the transfer function. To ease the problems of analysis and visualization, it is common practice to arrange the nodes in layers, with all nodes in adjacent layers connected to each other.

The "training" of the network is an iterative process based on large numbers of data samples representing the traffic flow within a certain region. Using standard connection weights, the network computes a set of outputs that is moved from the input layer to the hidden layer. The system compares this set of outputs with the input values by calculating a root mean square difference (or global error) and modifies the connection weights to displace the outputs toward the expected values. If the training is successful, the global error is reduced.

continued

A Neural Network Studies Traffic Patterns



Neural networks help classify traffic situations by mapping the detected traffic data to a set of defined traffic situations. However, they can predict only traffic flows they are used to.

SOFT & NET

Go beyond just surfing the internet

PRO-CONNECT

is our Internet installation disk for PCs. Within minutes, you will be accessing the Internet, using a range of professional software solutions supplied on the disk.

Make the Internet work for you:

- manage and integrate information
- improve communication with your customers
- enhance your in-house communication
- market your software

SOFT&NET offer the following Internet-related services:

- consulting and training
- World Wide Web services and LAN integration
- software tools
- software distribution

SOFT & NET DISTRIBUTION
THE INTERNET PEOPLE

Email: info@soft-net.co.uk

WWW: http://www.soft-net.co.uk/

Germany:
tel: +49 171 851 2 851
fax: +49 6034 8371

Switzerland:
tel: +41 22 360 1061
fax: +41 22 360 1061

UK:
tel: +44 151 794 3700
fax: +44 151 794 3684

browse, try, buy, get
on the internet

Circle 562 on Inquiry Card (RESELLERS: 563).

A traffic management system monitors the current status and dynamically forecasts the traffic density during the next 30 minutes. It helps traffic operators recognize changing traffic situations early. They can then modify traffic lights and message signs accordingly. The system estimates travel times and displays congested roads as colored sections on the operator's screen.

In the GERDIEN project, a separate back-propagation neural network was constructed for each prediction point (i.e., loop detector). Because forecasts of speed, flow, and occupancy were needed, and 5-, 15-, and 30-minute forecasting intervals were used, a single prediction point could have up to nine forecasting points (and associated neural networks).

The Good and the Bad

The GERDIEN project proved that neural networks can produce reasonable forecasts of traffic volume and occupancy. However, it also showed where they did not work.

"The forecast a neural network achieves is only as good as the data you used to train it," says Mark Dougherty a neural-network expert from the University of Leeds, who has been involved in the GERDIEN project. "As soon as unusual incidents that have not been trained occur, the net fails."

The GERDIEN project used a single network that had to cope with all traffic situations. Other approaches work with specific networks for different traffic situations. In this case, one needs a hierarchy of networks, including one that decides which one is applicable. According to Dougherty, the training of a system with several networks can get very fastidious, and the choice of "abnormal" situations is then likely to be dependent on the person who trained the network. ■

Paul van de Braak is a freelance writer who is based in the Netherlands. You can contact him on the Internet or BIX at editors @bix.com.

Where to Find

Boulevard PeriphÇrique
SRILOG
Solution Informatiques
102, bd de Valmy
92700 Colombes
France
+33 46 499347
fax: +33 46 499343

GREDIEN
TNO
Shoemakerstraat 97
P.O. Box 6041
2600 JA Delft
The Netherlands
+31 15 696770
fax: +31 15 697782

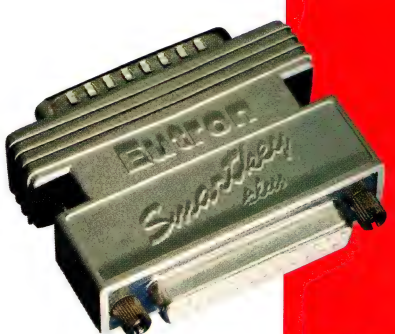
RHAPIT
Heusch/Boesefeldt
Liebigstr. 20
52070 Aachen
Germany
+49 241 168050
fax: +49 241 16805 55

SOCRATES
Ian Catling Consulting
Ash Meadow, Bridge Way
Chipstead
Surrey CR5 3PX
U.K.
+44 1737 552225
fax: +44 1737 556669

E U T R O N . C O M P U T E R S E C U R I T Y

Smartkey plus

PROTECTING SOFTWARE THE SAFE WAY



SMARTKEY PLUS is the professional protection system against illicit duplication of software.

The intelligent hardware key is plugged into the PC's parallel port: protected programs cannot be run without it.

Using programmable security codes, SMARTKEY PLUS protects software running under DOS, WINDOWS, WINDOWS95, WINDOWS/NT, OS/2, UNIX, AUTOCAD, NOVELL .

SMARTKEY PLUS comes in different models to protect any type of environment, from PC to LAN, whatever the application, from the simplest to the most sophisticated and demanding.

- Unique personal code
- Memory up to 448 bytes
- Programmable algorithms
- Protection through linkable drivers or automatic .EXE files protection technology
- LAN license control
- High security ASIC technology
- Fully transparent to parallel port use for printers, pocket network adapters, SCSI adapters, etc.
- Daisy-chainable

Eutron

EUTRON 24048 Treviolo Bergamo Italy - Via Gandhi, 12 - Tel. +39-35-201003 - Fax +39-35-201277 - BBS +39-35-201144

■ Belgium: Vicking 011-431272 ■ Finland: Dalma 90-2711800 ■ France: Logidata 1-46454546 ■ Slovenia: Stubelj 065-63215 ■ Sweden: JM Data 042-123145 ■ Spain: Larcu 91-7952413 ■ The Netherlands: Akkermans 045-241444

Circle 510 on Inquiry Card.

WHAT'S NEW Hardware

MONITOR ANALYZES YOUR WANS ▲

The Logix Monitor, Logix Communications' new PC-based WAN protocol analyzer, provides a concise view of your data in real-time and in background mode. It spools data in ASCII files for off-line analysis and lets you replay the data at various speeds. Triggers, timers, and counters are programmable and offer string searching, event trapping, exception alarms, data highlighting, and interactive simulation. An included alarm/modem interface activates a pager or beeper to keep you informed of network anomalies when you are away. Protocol decodes include X.25, frame relay, X.224, TCP/IP, and PPP.
Price: £1500.
Contact: Logix Communications
Wittshire, U.K.
+44 1380 722192
fax: +44 1380 727043.

Circle 1314 on Inquiry Card.

NEW PLUG-IN DATA ACQUISITION BOARDS

The DaqBoard/200A and 216 data acquisition boards provide 10-microseconds-per-channel scanning over their 16 on-board analog input channels and maintain the same performance over their 256 potential expansion channels. The boards digitize signals via a 16-bit, 100-kHz A/D converter, capable of real-time storage to disk. They provide three levels of software support: DOS and Windows programming language drivers and Visual Basic custom controls (VBXes), Windows-based setup and acquisition applications, and drivers for third-party software packages such as Snap Master, Labtech Notebook, DASYlab, and LabVIEW.
Price: £886.
Contact: Scensys
Arlesbury, U.K.
+44 1296 397676
fax: +44 1296 397878.

Circle 1318 on Inquiry Card.

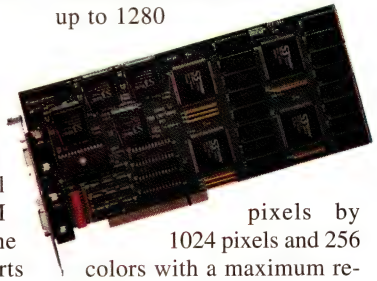
CABLE ANALYZER HELPS PREPARE FOR ATM ▼

The WireScope 155 is a category 5, level II cable tester that verifies that your UTP will operate with 155-MHz ATM equipment. According to the vendor, the analyzer supports ATM Forum requirements and TIA 568A specifications. It also guarantees compliance with the new T568A specification for category 5 cable testing and reports the margin by which the cable passed or failed. WireScope comes with a rugged rubber casing and field-changeable battery packs that give 5 hours of continual use.
Price: £3895.
Contact: MASE
Crydon, U.K.
+44 181 665 7577
fax: +44 181 6836440.

Circle 1315 on Inquiry Card.

PCI GRAPHICS ADAPTER FOR FOUR MONITORS ▼

If you're running multiple applications and need to increase your screen real estate, check out the Quad Lightning PCI graphic accelerator, which uses four independently programmable S3 Vision 868 chips. Included virtual screen software allows multiple screens to become one large desktop, configured horizontally or vertically. You can spread applications across several monitors or drag them from one screen to the next. Each monitor can run at resolutions up to 1280



pixels by 1024 pixels and 256 colors with a maximum refresh rate of 75 Hz. Drivers are supplied for Windows 3.x, Windows NT, OS/2, and Microstation. A two-port version of the Quad Lightning is available for PCI- and VL-bus architecture.
Call for price.
Contact: Colorgraphic Communications
Dorset, U.K.
+44 1202 669244
fax: +44 1202 67221.

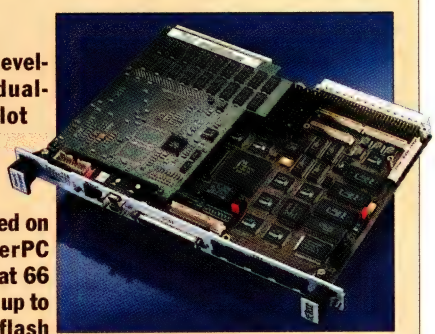
Circle 1316 on Inquiry Card.

GPS RECEIVER ON A PC CARD

Opti International's Global Positioning System (GPS) receiver on a Type II PC Card (formerly PCMCIA)lets users of notebooks, organizers, and PDAs obtain such exact location information as position, direction, altitude, and speed. The SatNav Card interprets signals received from the GPS network of satellites by emulating a serial communications port.
Call for price.
Contact: Opti International
Barking, U.K.
+44 181 507 1818
fax: +44 181 594 2236.

Circle 1313 on Inquiry Card.

POWERPC BOARDS FOR REAL-TIME APPLICATIONS



Force Computers developed its IBC-60x dual-PMC and single-slot VME boards for embedded real-time applications. The IBC-60x boards, based on the 603/604 PowerPC processors running at 66 or 100 MHz, provide up to 8 MB of on-board flash memory, two serial RS-232 I/O ports, and an Ethernet 10Base-T connector. They feature an optimized interrupt controller and an integrated linked-list DMA controller and support the real-time OSes VxWorks, pSOS+, and Lynox.

A single-slot version, the CPU-60xRT is also available. Both versions use PCI as a central on-board bus for data transfer rates up to 128 MB.

Call for prices.
Contact: Force Computers, Munich, Germany
+49 89 60814 0; fax: +49 89 60814 276.

Circle 1317 on Inquiry Card.

For Borland C/C++, Microsoft C/C++, Borland Pascal

RTKernel

Real-Time Multitasking for DOS

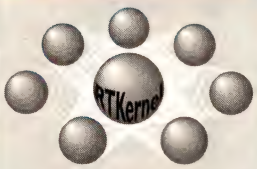
RTKernel is a professional, high-performance, real-time multitasking system for **MS-DOS** and **Embedded Systems**. It can use DOS device drivers and BIOS, and runs other DOS applications as a task - even **Windows!**

RTKernel is **loaded with features**: an unlimited number of tasks, excellent performance, a full set of inter-task communication functions (semaphores, mailboxes, synchronous message-passing), real and protected mode support, drivers for up to 38 COM ports and Novell's IPX services, and lots more...

It's **ROMable** and **very compact** (about 16K code, 6K data), making it ideally suited for Embedded Systems.

RTKernel is well-documented and easy to use. All hardware drivers always come with source code; kernel **source code available** at extra charge. **No run-time royalties.**

Join thousands of satisfied customers!



Use **RTKernel** for:
- process control
- data acquisition
- real-time simulations
- background processing

Free demo disk! Please request Info Kit B

Internet: http://www.on-time.com ftp.on-time.com info@on-time.com

Australia	Microway	(03) 589-1333
Denmark	Ravenholm Computing	44889900
France	Technology Rescue	1 30660136
Italy	Silicon Valley	(049) 871-3444
Malaysia	Pentatronics Technology	(04) 642-2595
Russia	ProSoft	(095) 971-2059
Sweden	Databiten	(026) 256493
Sweden	Linsoft	(013) 111588
USA	On Time Marketing	(516) 689-6654

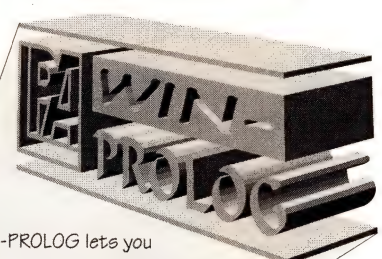
Libraries: DM 795
Source Code: add DM 695

On Time MARKETING
Professional Programming Tools

On Time Marketing · Karolinenstrasse 32 · 20357 Hamburg · GERMANY
Phone +49-40-437472 · Fax +49-40-435196 · CompuServe 100140,633

LPA-PROLOG puts you in the limelight!

Build Windows 3.1 applications that really shine! Genuine 32-bit applications on today's PCs.



LPA-PROLOG lets you build them the easy way: high level handling of dialogs, menus, graphics; DLL, DDE and ODBC interfaces; compact, fast and royalty-free runtime system.

Not to mention the source level debugger, multi-file editor, incremental and optimising compilers and Prolog library.

Let LPA-PROLOG put you in the limelight!

Logic Programming Associates Ltd
Phone (US Toll Free): 1-800-949-7567
Phone: +44 181 871 2016 - Fax: +44 181 874 0449
Email: lpa@cix.compulink.co.uk - Compuserve: 100135,134

NEW MULTIFUNCTIONAL STORAGE DEVICE

Cristie's new multifunctional storage device is a combination of a phase-change optical drive and a CD-ROM drive. Photon is housed in a rugged metal box complete with a carrying handle. It has SCSI and parallel printer ports that allow for quick and simple connection to your PC or laptop. Photon can be used for software installation, backup, or data interchange.

Price: £999.
Contact: Cristie Electronics, Stonehouse, U.K.
+44 1453 823611; fax: +44 1453 825768.

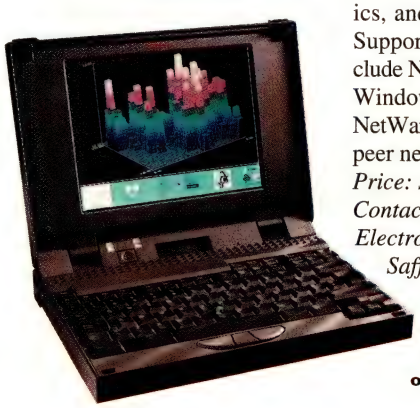
Circle 1320 on Inquiry Card.

SPARCBOOK DELIVERS MOBILE PERFORMANCE ▼

Tadpole's new notebook format SparcBook 3GX is equipped with a 110-MHz MicroSparc II processor, a high-resolution 800- by 600-pixel, 10.4-inch active matrix TFT display, and a 1.2-GB SCSI disk. Other features include two PCMCIA slots, built-in ISDN, a 14.4-Kbps data/fax modem, an Ethernet port, and SCSI ports. The SparcBook 3GX is aimed at such performance-driven applications as CAD, modeling and simulation, and database management.

Price: £9200.
Contact: Tadpole Technology
Cambridge, U.K.
+44 1223 428200
fax: +44 1223 428201.

Circle 1321 on Inquiry Card.



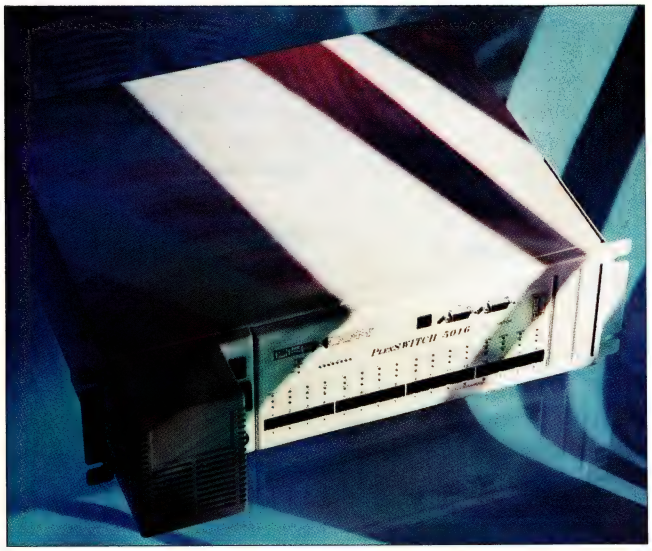
SERVER ACCELERATES GRAPHICS PRINTING

The PRS 750 print room server from Nighthawk Electronics addresses the problem of speed degradation on networks when printing large documents or drawings. It transfers data from the file server to the print server at the same speed as other network transactions, which should interest those in the CAD, graphics, and publishing businesses. Supported networking OSes include NetWare, Unix, Vines, and Windows NT, plus the Personal NetWare and LANtastic peer-to-peer networks.

Price: starts at £900.
Contact: Nighthawk Electronics
Saffron Walden, U.K.
+44 1799 540881
fax: +44 1799 541713.

Circle 1322 on Inquiry Card.

 Circle 560 on Inquiry Card (RESELLERS: 561).



NEW 16-PORT ETHERNET SWITCH ▲

ML Electro-Optics' new 16-port Ethernet switch, the PlexSwitch 5016, helps maximize Ethernet bandwidth. It does so by creating high-performance workgroups within congested LANs. Since it offers an internal switching capacity of 100 Mbps, all ports can intercommunicate at 10 Mbps simultaneously. Two external high-speed ports provide 100-Mbps access to high-performance file servers via FDDI or Fast Ethernet.

The PlexSwitch is based on a "store and forward" architecture and processes multiple packets in parallel. It is appropriate for users who have several standalone bridges in their network or who are considering an alternative to FDDI to obtain higher bandwidth.

Call for price.
Contact: ML Electro-Optics
Oldham, U.K.
+44 161 627 1100
fax: +44 161 678 0124.

Circle 1319 on Inquiry Card.

TAPE STATION CONNECTS DIRECTLY TO ETHERNET

Tape Station is a new series of tape drives that connect directly to any Ethernet LAN via either BNC or UTP connector. Each Station has a unique name so that several units can be installed. The devices offer capacities from 525 MB to 8 GB using data cartridges or DAT drives. All units ship with Windows and DOS software and include the ability to back up Novell file servers. Software for OS/2 and other OSes, including a Windows 95 version, are under development.

Price: starts at £1299.
Contact: Cristie Electronics
Stonehouse, U.K.
+44 1453 823611
fax: +44 1453 825768.

Circle 1340 on Inquiry Card.

FAST ETHERNET ADAPTER FOR PCI SYSTEMS

SysKonnect's Fast Ethernet adapter, SK-NET Flash 10/100, supports the 100Base-TX and the 10Base-T standards, so a protocol exchange from 10 to 100 Mbps is not necessary. The PCI bus–based system offers full plug-and-play slots, so that the PC automatically recognizes and configures the card after you've mounted it. The 32-bit bus offers internal data rates of 132 MBps. The card supports full-duplex operation and can increase the network bandwidth to 200 Mbps. The SK-NET 10/100 comes with drivers for NetWare, Windows, Windows NT, IBM LAN Server, and Unix.

Price: £529.
Contact: SysKonnect
Schneider&Koch
Ettlingen, Germany
+ 49 7243 502 0
fax: +49 7243 502 989.

Circle 1341 on Inquiry Card.

THE STRONGEST PRINTER RANGE

IN THE WORLD

IS HERE

Here, at your local distributor, is the reliable and high quality dot matrix, line, inkjet and laser printer range from Mannesmann Tally: products for all your applications.

AUSTRALIA GPM Systems 03 819 0233 **BAHRAIN** Mantech Computer Services 0731717 **BELGIUM** Tracor Europa NV 02 5820031 **CHINA** Einstein Technology Industries Ltd 7 336 9580 TAIWAN ROC **CYPRUS** The Cyprus Import Corp Ltd 2337033 **DENMARK** Iversen & Martens AS 44921100 **EGYPT** Microsys 02 2916426 **FINLAND** Jertec Oy 90 52711 **GREECE** Unicom SA 01 9430632/3 **HONG KONG** Clever Motion Industries Ltd 07870778 **ICELAND** Einar J Skulason HF 01 633000 **INDIA** Lipi Data Systems 022 2026860 **INDONESIA** PT Pantja Indohitech Komputer 021 3101066 **IRAN** Varian Of Iran Co Ltd 21 7762703 **ISRAEL** Alpha Terminals Ltd 03 6487795 **JORDAN** Computer and Communications Systems 844088 **KENYA & EAST AFRICA** Micropower International Ltd 2 540198 **KOREA** International Business Computer Co Ltd 784 8301 **KUWAIT** Sinam Integrated Systems 4834542 **LEBANON** Information Management Ltd 01 601786 **MALAYSIA** Advantage Systems SDN.BHD 3 7033166 **MALTA** Philip Toledo Ltd 444747 **THE NETHERLANDS** Tracor Europa BV 033 536536 **NEW ZEALAND** Pegasus 838 2081 **NIGERIA & ALL ECOWAS COUNTRIES** Isatong Ltd 01 841485 **NORWAY** Merkantildata 2 2095000 **OMAN** Capital Computer Centre LLC 590400 **PAKISTAN** Alrashid Microcomputers (PVT) Ltd 21 442026 **PHILLIPINES** Maxicom 2 6355116 **PORTUGAL** D&R Lda 01 778 7928; Citronic 01 828151 **QATAR** BCQ 325851 **SAUDI ARABIA** National Computer Systems Co 1 479 3916 **SINGAPORE** Kesco Information Technology PTE Ltd 484 1417 **SOUTH AFRICA** Venture Computer Co (Pty) Ltd 11 792 7430 **SPAIN** SDI 1 510 7100; Benett Associados 1 677 8881 **SWEDEN** MD Distribution 87 520045 **SYRIA** Yazigi & Co 11 2215583 **TAIWAN** Einstein Technology Industries Ltd 7 336 9580 **THAILAND** Yip In Tsoi & Co Ltd 2 236 9294 **TURKEY** Performans 212 288 5260/1; EBIM Ltd 392 228 1543 **UNITED ARAB EMIRATES** International Aeradio (Emirates) 4 523331 **YEMEN** Computer Information Centre 1 226959; Yemen Computer Co 1 208811 **ZIMBABWE** Speciss Computers 4 794661

Call +44 1734 788711 for details of your local distributor or **Fax +44 1734 771312**
Mannesmann Tally Ltd., Molly Millars Lane, Wokingham RG41 2QT. UNITED KINGDOM

MANNESMANN Tally

SEE US AT GITEX STAND X 3-1

Circle 527 on Inquiry Card.

WHAT'S NEW

DRIVE EIGHT MONITORS WITH A MAC ▼

The new VOPEX-8M video splitter lets a single Mac drive up to eight video monitors, all displaying the same

image. With a 100-MHz bandwidth, this device displays images that are as crisp as the originals. All monitors connected to the VOPEX must be the same type. The unit connects directly to the Mac's video-out port via an included 3-foot interface cable. Because all eight outputs are individually buffered, the monitors don't affect one another.
Price: £692.
Contact: Instrumentation Test & Measurement
Wimborne Dorset, U.K.
+44 1202 872771
fax: +44 1202 871052.
Circle 1312 on Inquiry Card.

INTELLIGENT ENERGY SAVER

The IES (for Intelligent Energy Saver) remote controller with built-in modem can automatically turn PC systems, monitors, printers, and fax machines on and off. For example, the IES's scheduling function lets you turn the system on only during standard working hours. You can also automate the system to allow backups, E-mail, or long-distance fax messaging to take place at off-peak times, when charges are lower. If control on demand is required, you can operate the IES via the internal modem link, which lets you receive faxes without leaving the system on continuously. Additional energy-saving features include automatic printer or monitor shut down and automatic power off when the IES detects an unstable power source.
Price: £145.
Contact: Network Connectors
Bristol, U.K.
+44 1275 848421
fax: +44 1275 848421.
Circle 1342 on Inquiry Card.

TWIN MONITOR MAPPER

TWIN for Windows maps your Windows desktop over two or more monitors. When used with the Tornado PCI graphics board, TWIN enables each screen to provide a resolution of 1280 by 1024 pixels in true color or 1600 by 1280 in 65,000 colors. TWIN for Windows includes a utility that lets users configure the system so that any standard Windows software will run on either screen or split across screens as if they were one huge monitor.
Price: £150 (without graphics boards).
Contact: Datapath
Derby, U.K.
+44 1332 294441
fax: +44 1332 290667.
Circle 1343 on Inquiry Card.

MO DRIVE WITH ENHANCED IDE INTERFACE

Fujitsu's M2541 MO magneto-optical storage drive for portable computers is a 17-mm high, 250-gram removable/rewriteable system that uses 3½-inch disks and offers 230 MB of storage. Due to its intelligent power management, the M2541 draws only 0.2 W in sleep mode. An Enhanced IDE interface eliminates the need for a SCSI card and enables connectivity to any PC architecture.
Price: £299.
Contact: Fujitsu Europe
Uxbridge, U.K.
+44 181 573 4444
fax: +44 181 573 2643.
Circle 1345 on Inquiry Card.

ADONIS Micro-Software

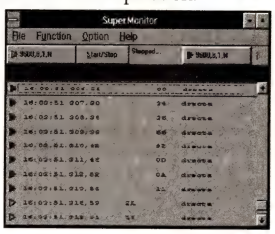
SuperMonitor for DOS , Windows

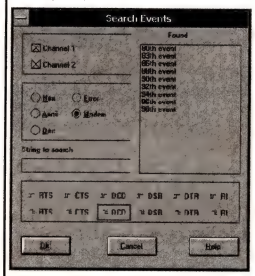
The flexible and versatile solution for your serial data and protocol analysis. The continous graphic user interface for DOS and Windows* guarantees an easy operation. SuperMonitor is very quickly attached to a serial data transmission and is a silent but watchful observer of the operation.

You are now able to considerably reduce your development time and costs when setting up or monitoring a serial link by using SuperMonitor.

SuperMonitor is able to execute not only simple short measurements but also long day and night runs. In Windows 3.x up to two measurements can run simultaneously using the Twin version.

You even have the possibility as developer to extend SuperMonitor by using *SuperCom* the heart of SuperMonitor.





- flexible software solution
- up to 115 KBit baud rate
- parity: none, even, odd, mark, space
- stop bits: 1, 1.5, 2
- data bits: 5, 6, 7, 8
- time stamps with a precision of 10 µs
- display of all modem lines
- dynamic trigger function
- extensive display, print and search functions
- limited buffer only through the PC memory
- data swap-out for long day and night runs
- display modes: ASCII, Decimal, Hexadecimal
- up to two simultaneously running measurements in Windows
- IRQ0..IRQ15 and any port address
- includes special adapter, cabel and 16bit serial board

SuperMonitor for DOS only $398
SuperMonitor for Windows only $498
SuperMonitor for DOS+Windows only $768
SuperMonitor for Windows Twin only $748
SuperMonitor for DOS+Windows Twin only $998
*Windows=Windows 3.x + Windows 95

BBS: +49-7043-9000-23 (User=ADONTEC, Password=ADONTEC) ○ DEMO on CompuServe. Forum: WINSDK, Key: RS232 or product name.

RS232-Toolkit, SuperCom for DOS, Windows, OS/2, NT, WIN 95

for MS C/C++, Visual C++, Turbo/Borland C/C++, Turbo/Borland Pascal, Delphi, IBM C/C++, WATCOM C/C++

SuperCom is the development tool for exacting serial communication software. That means high data security and highest transmission speed. The SuperCom libraries are fast even in a multitasking operating system like Windows 3.x, NT, Windows 95 or OS/2. The same programming interface is used among different languages and operating systems.

- Interrupt driven: transmission, reception, linestatus, modem status. Up to 115,200 bps.
- UARTS: 8250,16450, 16550 FIFO, any port address.
- Simultaneous COM_1..COM_36 (and unlimited).
- Direct register programming*. Interrupt-Sharing.
- Flow control: RTS/CTS, DTR/DSR, XON/XOFF and user defined. ANSI, TTY, VT52.
- Protocols: ASCII, XMODEM, XMODEM/CRC, YMODEM, YMODEM/BATCH, ZMODEM.
- Timer, Ctrl-Break and Exception handling.
- Multitasking support (Windows, NT, WIN95, OS/2)
- User Event Routines under DOS and Windows.
- Under Windows user can even post messages to the application using *PostMessage*.
- Language independent DLL (Windows, NT, WIN95, OS/2) which can be used for simultaneous transfers by applications.
- Multiserial board support (AST, ARNET, DigiBoard PC/X, HOSTESS, STARGATE). Reduces loading of CPU through support of intelligent DigiBoard PC/Xe, PC/Xem, PC/Xi boards (up to 7 Boards/PC !!!).
- Modem support, RS422/485 support.
- Supports 286 DOS-Extender (e.g. PharLap, Borland)
- NO ROYALTIES. No resident drivers*. Just link the LIB.
- FREE technical support. FREE demo
- Full source code (C or Pascal and optimized ASM).
- SuperCom++ (C++ or Pascal OOP) included.
- Protected Mode Interface (Windows) included.

C/C++ or Pascal package for DOS only $299
C/C++ or Pascal package for Windows, OS/2 or NT each $399
C/C++ or Pascal combo pack for DOS+Windows only $528
C/C++ combo pack for DOS+Windows+OS/2 only $799
C/C++ combo pack for DOS+Windows+NT only $799
C/C++ combo pack for DOS+Windows+OS/2+NT only $999
*Under DOS and Windows. Windows=Windows 3.x + Windows 95 16bit, NT=Windows NT + Windows 95 32bit

VISA, MC, COD.

NEW!!! COMM-Enhancer for Windows 3.x

Forget the Windows 3.x COMM API limitations. Use the COMM-Enhancer and extend your Windows 3.x COMM API based applications. Up to 40 channels (COM1...COM40!) and up to 115.200 bps. It uses SuperCom 3!!!
Price $299 (together with any SuperCom combo supporting Windows 3.x $199!)

ADONTEC Computer Systems Ltd
Hoelderlinstr. 32
D-75433 Maulbronn, Germany
Phone: +49-7043-9000-20
FAX: +49-7043-9000-21

Fine Line International
7000 Malone Rd, Forestville
CA 95436, USA
Phone: +1-707-887-3400
FAX: +1-707-887-1015

In Israel, call:
Phone: +972-3-924-3555
FAX: +972-3-924-3132
In Italy, call:
Phone: +39-49-8713444
FAX: +39-49-8713055

Circle 542 on Inquiry Card (RESELLERS: 543).

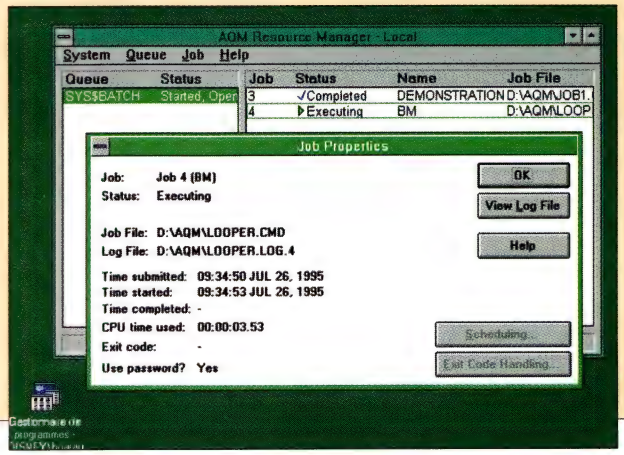
WHAT'S NEW Software

SDK CREATES DOCUMENTS THAT "SPEAK" ITALIAN AND KOREAN

Lernout & Hauspie's Text-to-Speech software development kits are now available in Italian and Korean. The system converts written text in word processing documents, spreadsheets, and databases into natural-sounding speech. With the Text-to-Speech SDK, developers can integrate the technology in Windows 3.1 and Windows 95 applications. The SDK includes a DLL, sample programs, API function reference and language-specific reference guides, and user-defined exceptions dictionaries.
Price: US$1995.
Contact: Lernout & Hauspie
Woburn, MA
(617) 932-4118
fax: (617) 932-9209.
Circle 1323 on Inquiry Card.

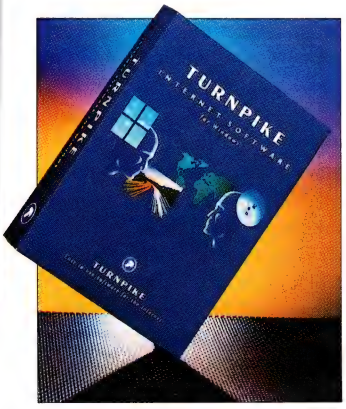
MAINFRAME-LIKE JOB SCHEDULING FOR NT

Argent Queue Manager (AQM) 2.3, a batch job scheduler for Windows NT, has features typically found in a mainframe batch job scheduling system. AQM 2.3 has full dependency support, alerting sequences for job failure, and time-zone support. Its Batch Control Language lets you download files from legacy systems. AQM can be installed remotely from a local computer and gives the system manager the flexibility to submit a job under a user's account.
Price: US$1980.
Contact: Sunbelt International
Rueil-Malmaison, France
+33 1 47770500
fax: +33 1 47770299.
Circle 1330 on Inquiry Card.



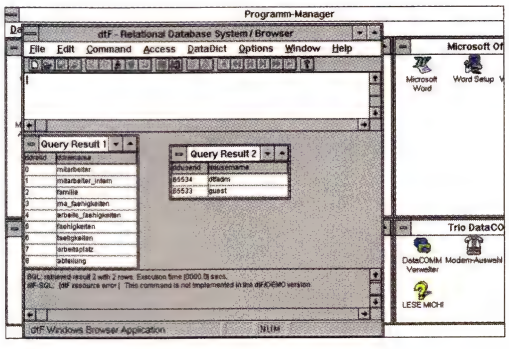
INTERNET ACCESS SOFTWARE FOR LANS ▼

Turnpike is an integrated Internet access program for Windows that is designed for dial-up users. It includes E-mail and a news reader as well as FTP, Telnet, Finger, and Ping. With Turnpike, you can have several mailboxes and more than one address. An address book automatically records all E-mail addresses. The multiuser version works on a LAN so that only one file server is required to handle mail and news. Turnpike is MIME-compliant and includes SMTP server, POP3, POP2, and NNTP. The included Winsockets, TCP/IP stack and PPP/SLIP drivers let you access the World Wide Web.
Price: £99 for a single PC; £249 for a five-user license.
Contact: Turnpike
Dorking, Surrey, U.K.
+44 1306 747747
fax: +44 1306 747749
http://www.sunbelt.co.uk.
Circle 1324 on Inquiry Card.



WEBMANAGER PUBLISHING ON THE WEB

Descartes' Webmanager is a new tool for publishing on the World Wide Web. It comprises user-definable data-entry screens with an "HTML merge" function and a customizable editor. Webmanager-designed templates are automatically uploaded to your Web server. A repository tracks all changes to ensure you have a separate update of your work. The vendor claims that Webmanager helps users who are not familiar with HTML run a Web site with a minimum of bother.
Price: Starts at £400.
Contact: Descartes Solutions
Manchester, U.K.
+44 161 953 4114
fax: +44 161 953 4108
http://www.u-net.com/descartes.
Circle 1325 on Inquiry Card.

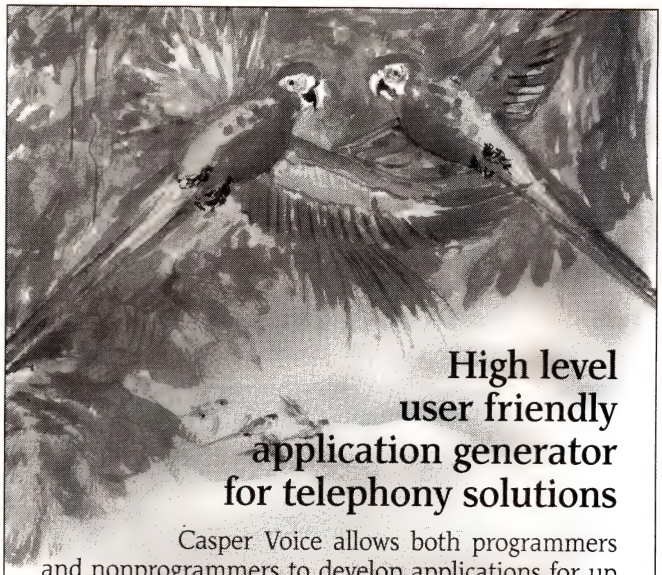


DATABASE FOR APPLICATION DEVELOPERS ▼

The DTF relational database system for applications developers comes as a library of C/C++ functions and provides dynamic SQL so that the source code is readable even during a debugging process. It uses virtual memory techniques, special cache modules, and a client/server architecture to enhance performance in environments with little memory. DTF uses separate "Workspaces" to process queries simultaneously and includes error recovery as well as backup and restore modules. It runs under DOS, Windows, and OS/2 and supports such 32-bit compilers as Watcom C 9.5, Borland C++, GNU C, and IBM C++ Tools.
Price: Starts at DM 460.
Contact: SLAB
Holzgerlingen, Germany
+49 7031 604449
fax: +49 7031 604223.
Circle 1326 on Inquiry Card.

MPEG RECORDING SYSTEM

Easy-CD Video is Windows CD recording software that follows the White Book Video CD specification. It lets you rearrange, add, and delete video clips and reportedly supports all CD recorders currently on the market. With Easy-CD, you can drag and drop MPEG track files from the files manager into the program window. Any connected CD recorder is automatically recognized and installed.
Call for price.
Contact: Incat Systems
Milano, Italy
+39 2 3931 1341
fax: +39 2 3931 1374.
Circle 1333 on Inquiry Card.



High level user friendly application generator for telephony solutions

Casper Voice allows both programmers and nonprogrammers to develop applications for up to 30 ports per PC, using a wide range of Dialogic products. Future users of Casper Voice are offered a demo diskette free of charge.

Casper

Roskildevej 126
4100 Ringsted
Denmark

Phone +45 57 67 30 00 · Fax +45 57 67 40 45

Used by BT Laboratories, Nortel and Philips

Subscribe Now!
+1-609-426-5526

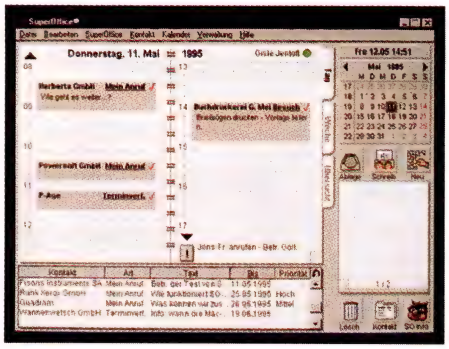
BYTE is the global authority for technology integration. BYTE provides technology experts with in-depth coverage of emerging technologies, leading-edge products, and interoperability for enterprise-wide computing.

Subscribe Today!
Outside the US 1-609-426-5526
fax 1-609-426-5434

Subscription rates:
US $24.95
Canada or Mexico $29.95
Outside North America $60.00 surface delivery; $85.00 airmail delivery

All rates are quoted in US funds; please inquire for foreign rates in local currency.

BYTE
Because the *Experts* decide.



NETWORK-READY CONTACT MANAGEMENT ▲

SuperOffice 3.0 is a network-ready contact management software package for Windows that includes calendar sharing between users, group scheduling, inter-office E-mail, and document image processing. It offers access to corporate databases and linkups to employees in the field. The system works with existing word processors and spreadsheets, so you can continue to use your favorite applications.

With SuperOffice, you can create several projects and track the progress of each, assign internal and external users, and cross link between contact records and the project.

Price: DM 610 for a single user; DM 2430 for a five-user license.
Contact: SuperOffice
Oslo, Norway
+47 22 83 1550
fax: +47 22 83 5590.

Circle 1332 on Inquiry Card.

MAXIMIZE YOUR SALES CONTACTS

Maximizer for Windows is a contact management package that offers a complete range of features for client and prospect follow-up. Features include a client database with an unlimited number of contacts per client and unlimited notes on each client and contact level. The software comprises an integrated word processor with spell checker, extensive mail-merge facilities, standard reports, an agenda with "hotlist" features, group scheduling, and automatic action logging. Maximizer is available in a stand-alone or LAN version covering all major network platforms.

The vendor also offers the qualification and forecasting system SalesVision that rates and monitors progress of potential orders and contracts.

Price: Maximizer, £330; SalesVision, £950.
Contact: Nomis
Camberley, Surrey, U.K.
+44 1276 22168
fax: +44 1276 22168.

Circle 1327 on Inquiry Card.

SCRIPTED WINDOWS LOG IN TO NETWARE

WinLogin lets you log in to your NetWare LAN directly from Windows and, therefore, offers a Windows replacement for the Novell DOS Login program. WinLogin offers full support of log-in scripts. It features a Windows batch-command processor and supports bindery and NDS. Network Utilities says the software is particularly useful where users rely on asynchronous remote connections to a server.

Call for price.
Contact: Network Utilities
Surbiton, U.K.
+44 181 391 9200
fax: +44 181 391 9233.

Circle 1336 on Inquiry Card.

ELECTRONIC FILING FOR YOUR OFFICE

EGAMI is a complete office filing system that includes document image processing and an 8-pages-per-minute scanner. Within each file, you can create up to 26 sections to control and process documents. It lets you rotate, enlarge, and mark images. You can also attach comments and descriptions to documents and images. The system supports optical WORM disks and CD jukeboxes for archiving.

Price: Starts at £1995.
Contact: DP Advisers
London, U.K.
+44 171 834 4068
fax: +44 171 630 7952.

Circle 1328 on Inquiry Card.

MULTIMEDIA AUTHORING WITHOUT PROGRAMMING

The SMARTbook for Windows multimedia authoring program includes background-generation tools, a simplified command structure for creating hyperlinks via buttons, and hot area and hot words. It supports AVI video and high-resolution fractally compressed images.
Price: £299; £99 for SMARTbook Lite.
Contact: Frax
Aberdeen, Scotland
+44 1224 621144
fax: +44 1224 620789.
Circle 1335 on Inquiry Card.

SCAN AND CONVERT IMAGE FILES

Sentfactor Image Viewer helps you find images on your PC. It lets you scan the contents of each directory until you recognize the particular image that you want. The Image Viewer not only includes a slide show utility and 200 stock photography images, but it also lets you convert among 15 common file types including BMP, CALS, JPEG, MAC, RAS, and WPG.
Price: US$29.
Contact: Sentfactor
Galway, Ireland
+353 91 94393
fax: +353 91 90644.
Circle 1337 on Inquiry Card.

DEVELOPMENT ENVIRONMENT FOR DISTRIBUTED OBJECTS

JBA Guidelines is a software development environment for generating graphical client/server applications for the workgroup up to the enterprise. The latest version, 3.1, introduces a messaging layer that ensures that all applications are object-enabled and, therefore, can be used in object-oriented databases and OSes with minimal amendment. It is targeted at COBOL, Basic, C, and C++ development teams. Guidelines lets you create programs that run on the PC and on the server platform.

The new CORBA-compliant messaging layer provides an interface between object calls and code. The vendor claims that the coexistence of traditional and advanced object technology enables an evolutionary migration from client/server to distributed objects.
Price: Starts at £595.
Contact: JBA
Studley, U.K.
+44 1789 400212
fax: +44 1789 400675.
Circle 1334 on Inquiry Card.

RAD TOOL FOR EMBEDDED SYSTEMS

Nohau's Codewright, a Windows-based programmer's editor for embedded projects, lets you select text by line and column, automatically change a variable name across different files, and open a large number of files with a single command. You can customize Codewright's interface to suit particular menu and command preferences. It also features "CromCoding," allowing color coding of commands, keywords, strings, numbers, and commands.
Price: £185.
Contact: Nohau
Hampshire, U.K.
+44 1962 733140
fax: +44 1962 735502.
Circle 1347 on Inquiry Card.

MULTIMEDIA PRODUCTION TOOLS

MediaShop for Windows offers comprehensive animation, sound editing, and media-integration tools. This multimedia production package is aimed at developers, trainers, animators, and designers who need to create corporate presentations, point-of-sales kiosks, or interactive games. The Motion Editor module provides cell- and path-based animation capabilities. The integrated Paint Program features 24-bit color, onion skinning, and antialiasing. The Sound module offers special effects such as amplify, echo, fade-in, and fade-out in 16-bit stereo quality.
Call for price.
Contact: Gomark Ltd.
London, U.K.
+44 171 731 7930
fax: +44 171 736 1215.
Circle 1348 on Inquiry Card.

Circle 545 on Inquiry Card (RESELLERS: 546).

BET YOU'VE GOT A FILE THAT TAKES 20 MINUTES TO ACCESS

Oh yes you have. It's not in a buffer. It's in a buff folder, in the drawer of someone who shouldn't have taken it out of the filing cabinet in the first place.

Why, oh why, are you still working with paper filing ? Look at EasiFile: the plug and play, network ready, electronic filing system.

Starting at just £5,750, including Pentium PC, scanner and optical disk storage, it's about half the price of other DIP systems. And makes file access quick and easy.

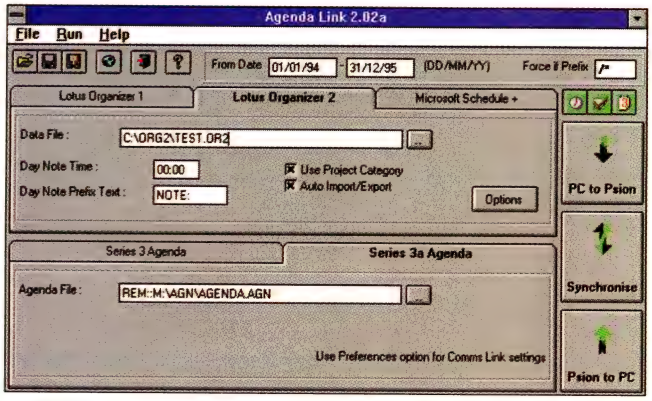
For further information - and a free guide to Electronic Filing - return the coupon or call free on 0800 37 11 86. Reseller enquiries welcome.

MDi BE A WELL DOCUMENTED SUCCESS

Yes, please send me details of EasiFile - and MDi's free Guide to Electronic Filing.
Send to: MDi Systems Ltd., Newmains, Stenton, Dunbar EH42 1TQ UK.
Name _____
Position _____
Company _____
Address _____
_____
Postcode _____
BYINT/OCT

email: easifile@mdisystems.co.uk **Internet:** http://www.mdisystems.co.uk/easifile
snailmail: MDi Systems Ltd, Newmains, Stenton, Dunbar, Scotland, EH42 1TQ UK.
Telephone: **Asia/Pacific Rim** (852) 2545 0567 **Holland:** (43) 672192
USA: East Coast (703) 356 9803 West Coast (415) 655 3765 Central (214) 387 2855
Overseas enquiries to UK: Telephone (44) 1368 850 650 Facsimile (44) 1368 850 679

WHAT'S NEW



SYNCHRONIZE YOUR AGENDAS ▲

Agenda Link 2.0 converts and synchronizes information from the Agenda software running on the Psion Series 3 or 3a and Lotus Organizer versions 1 and 2. It lets you convert diary and anniversary data one-way and synchronize two Agendas. You can even save a file directly to the Psion's internal drive.
Call for price.
Contact: Widget Software
Knebworth, U.K.
+44 1438 815444
fax: +44 1438 815222.
Circle 1331 on Inquiry Card.

ADD AN ENCRYPTED DRIVE TO YOUR SYSTEM

ZSafe for Windows and DOS creates an additional, secure drive on your PC hard disk. The drive's contents are encrypted and decrypted on the fly. The physical size of the virtual drive is dynamically adjusted and requires only enough space to store the logical contents.
Price: US$199.
Contact: Zincom
Knutsford, U.K.
+44 1565 650383.
Circle 1338 on Inquiry Card.

NEW HELP DESK AUDITOR

The Barefoot Auditor—Support Edition helps IT administrators and support staff analyze a PC's configuration. It provides a simple means of identifying all files on a PC and grouping them by function. An expert system analyzes the content of executable files and produces a number of standard reports, including memory managers, mouse and screen drivers, and fonts.
Price: US$277 for a single PC; US$877 for multiple PCs.
Contact: Pathfinder
Stockport, U.K.
+44 161 406 7399
fax: +44 161 406 7410
http://www.u-net.com/pathfinder/.
Circle 1339 on Inquiry Card.

WIZRULE ANALYZES DATABASE LOGIC

WizRule for Windows is a new database-auditing tool that discovers rules and errors in a database. It is based on an algorithm that reveals the rules independently and detects deviations from those rules. By focusing on the deviations, you can identify errors in the database contents and correct them. It can produce reports and read Xbase, Paradox, and Access files and other ODBC-compliant databases.
Price: £330.
Contact: Softwerk
Arlesley, U.K.
+44 1462 832244
fax: +44 1462 832288.
Circle 1346 on Inquiry Card.

A Message to Our Subscribers

From time to time we make the BYTE subscriber list available to other companies whose products or services would be of interest to our readers. We take great care to screen these companies, choosing only those who are reputable. Furthermore, subscriber names are made available for direct mail purposes only; telemarketing calls are strictly prohibited.

Many BYTE subscribers appreciate this carefully managed program, and look forward to receiving information of interest to them via the mail. While we believe this information is of benefit to our subscribers, we firmly respect the wishes of any subscriber who does not want to receive promotional literature. Should you wish to restrict the use of your name, please send your request (including your magazine mailing label, name, address, and subscription account number) to:

BYTE Magazine Subscriber Services
PO Box 555 Hightstown, NJ 08520

BYTE

A Division of The McGraw-Hill Companies

Working in the Code Mine

DENNIS BARKER

It's hell working at Microsoft. Or so it is for the techno-turks in *Microserfs*, a zippy novel about 20-somethings hacking away in Mr. Bill's code mines. In the great work literature of the past, cruelly oppressed laborers slaved in slaughterhouses, sloshing around in guts and gore. These kids are bummed because they have to stay up all night debugging, trying to meet shipping dates, strung out on Chee•tos and Tab, living in fear of being flamed by Bill.

Meanwhile, they exist day by day, line by line, lamenting their lack of personal lives ("my universe consists of home, Microsoft, and Costco"), plotting their escape from Redmond, and being sure to check Microsoft's NASDAQ price.

The main characters are programmers—narrator Daniel works in product testing—but they talk more like industry groupies. They make a few obligatory references to C++ and class libraries, but mostly they talk Silicon Valley trash: the differences between Microsoft and Apple ("better cafeterias" versus "better nerd toys"), the "weird" corporate culture at Intel (staffers are suspected of being cyborgs), gossip, why Windows is counterintuitive, and the Cult of Bill. And they whine, oh how they whine, that they're not "One-Point-Oh"—the first people to work on the first version of something. Being One-Point-Oh is what makes you a Cyberlord rather than a Microserf.

ILLUSTRATION: WILLIAM GRAEF © 1995

Coupland gets a little too cute sometimes, and his characters tend to talk like sitcom people, always quick with the riposte and bubbling with witty asides. But his observations are dead-on; he's much funnier than anyone writing in the high-tech press. There's a great scene set in a meeting with venture capitalists. Daniel uses pop metaphors to describe the money types. There's "VC Woman with Barbra-Streisand-in-Concert Hairdo" and "Young VC guy, who would be the same age as Rosemary's Baby."

Coupland's treatment of computers is more cultural than technical. They are props rather than an essential part of the story. In fact, he's more interested in the low-tech knickknacks of the social landscape than he is in computing technology. For every reference to a Pentium or the Internet, there are a hundred mentions of warehouse stores, Pop-Tarts, Legos, *Melrose Place*, CNN, and aerosol cheese.

But that's OK. Coupland uses these cultural bits to good effect. Daniel describes his housemates in terms of their dream *Jeopardy* categories. There are enough pop references in this book to fill a CD-ROM on merchandise and entertainment of the late twentieth century.

Coupland's story is only partially about working at Microsoft. Mostly, it's about people and their relationships, not about the epic struggle to link objects. It's all seen through the eyes of 20-year-olds, but don't let that scare you away. The concerns here are universal: family, friends, and making a living.

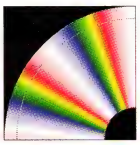
Compared to some of the great work novels, *Microserfs* doesn't have the weight of Upton Sinclair's *The Jungle*, and it doesn't have the low-down grit and pathos of Charles Bukowski's *Post Office*. But it's a pretty good story, sometimes touching, often funny, and it's a very entertaining chronicle of life in these weird times. ■

MICROSERFS

Douglas Coupland
Regan Books/HarperCollins
ISBN 0-06-039148-0

$21

Dennis Barker has never worked in a code mine, but he's held a variety of editing positions at BYTE. You can reach him on the Internet or BIX at dbarker@bix.com.



MARILYN REMEMBERED

BERNARD OF HOLLYWOOD'S MARILYN
Corel Corp., 1600 Carling Ave., Ottawa, Ontario, Canada K1Z 8R7, (613) 728-8208, $69.95

I have always had a fondness for Marilyn Monroe. After all, we share the same birthday (June 1). But my fondness never turned into the fascination that many die-hard fans have for the platinum blonde beauty. Bernard of Hollywood's Marilyn (which works on Macintosh System 7.0 or Windows 3.1 or higher) traces her life from the early days as Norma Jean to that tragic day (August 5, 1962) she died. The disc is based on a book of the same title by Susan Bernard, daughter of renowned Hollywood photographer Bruno Bernard, often described as the "discoverer of Marilyn Monroe."

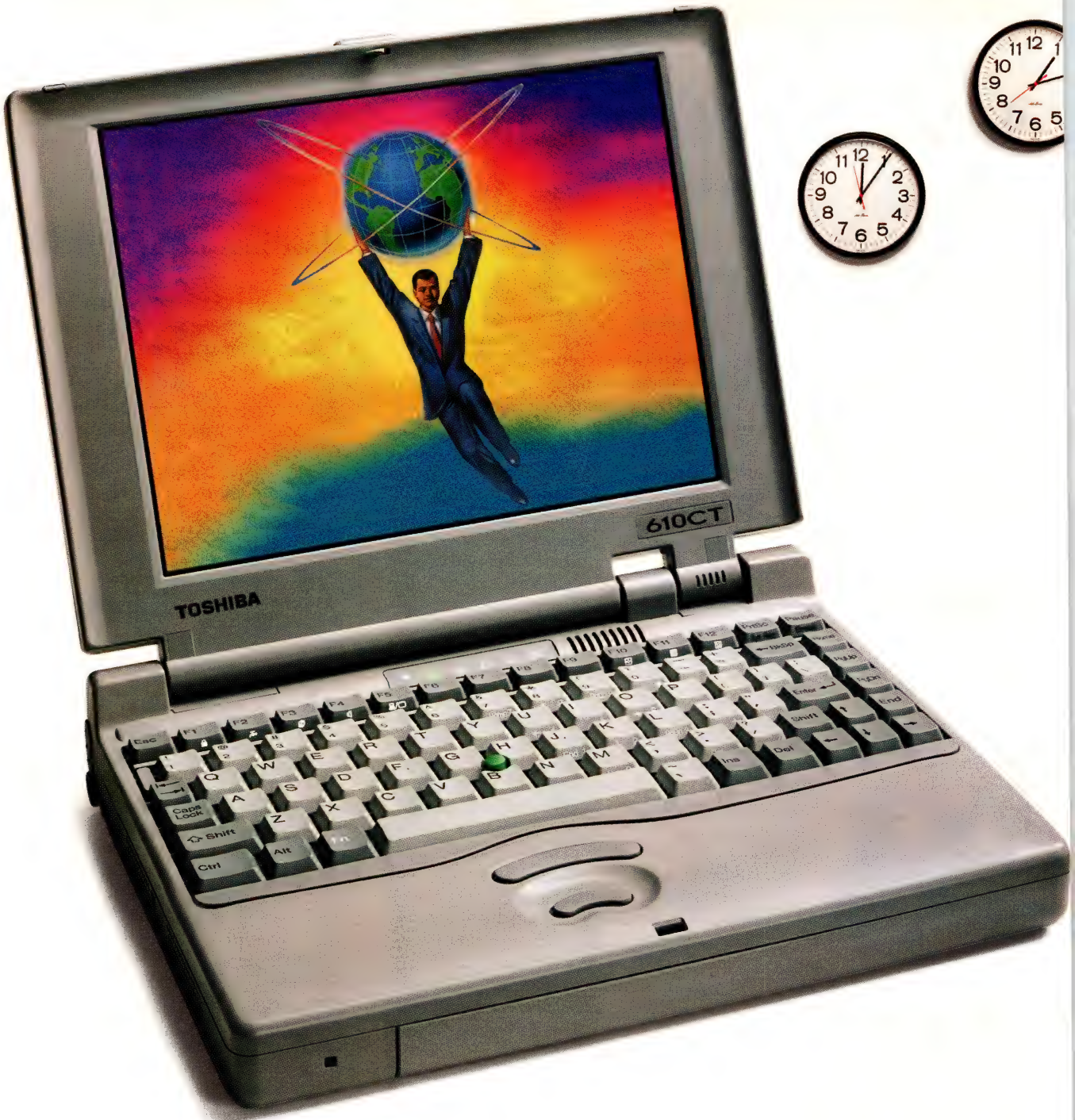
Accompanied by a jazzy 1950s sound track, you can page through Susan Bernard's text, which offers links to audio and video clips of Monroe. You can also listen to the journal entries of Bruno Bernard. The video clips are highlighted by Monroe's famous rendition of "Happy Birthday" sung to John F. Kennedy, her original screen test, and newsreel footage of Joe DiMaggio at Monroe's funeral. And there's also a screen saver of, guess who, on the CD-ROM.

You also get a time line of Monroe's life, which includes a glossary of her 29 films and a list of 103 "essential" Marilyn Monroe facts. Only the truly obsessed fan would care that Monroe had a weakness for chocolate éclairs, that her dress size was 12, and that her favorite snack was caviar.

I was, however, impressed with Bruno Bernard's photographs of Monroe. The disc includes a number of his works, and it's easy to see how they helped Monroe become a legend.

As the cake comes out and my family begins to sing, I'll remember Monroe, but don't ask me to tell you that her pant size was nine.

—Jeff MacClay

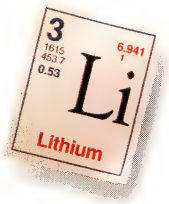


THE NEW ULTRAPORTABLE PORTÉGÉ™.

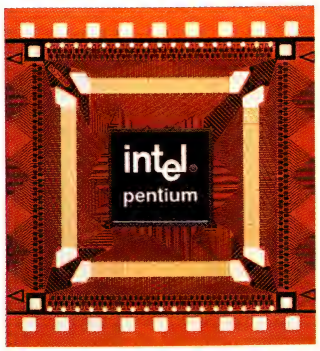
Toshiba engineers have done it again. Now you can get the incredible speed of a 90MHz Pentium™ processor in an ultraportable. The top-performing Portégé 610CT is packed with all the sophisticated features you'd expect in a full-size computer. A Lithium Ion battery provides up to five hours of use — without a recharge. Add to that, a spacious 720 Million Byte HDD, a large 9.5" diagonal color display, two stacked PC Card slots, a captivating sound system and an optional Port Replicator for one-step connection to your desktop. See how far Toshiba has taken every aspect of portable computing. And think where it can take you. **Call 1-800-457-7777 for your nearest dealer.**

PORTÉGÉ™
610CT

Up to 5 Hours of Battery Life



MINIMIZE MASS. MAXIMIZE ACCELERATION.



90MHz Pentium™ Processor

The Portégé legacy. *The Portégé Series has won prestigious awards including PC Computing's Product of the Year and Portable MVP and PC Magazine's award for Technical Excellence.*

PCComputing MVP WINNER

PCComputing MVP '94 PRODUCT OF THE YEAR

1994 – WINNER – PC Magazine Award for Technical Excellence

HARDWARE Toshiba Portégé Series Toshiba America Information Systems Inc.

PC Card expandability. *Two stacked PC Card slots (two Type II or one Type III) leave your options for storage, fax/modems, networking and the future wide open.*

PORTÉGÉ 610CT FEATURES:

- 90MHz Intel Pentium™ processor
- 9.5" dia. 24-bit color TFT active matrix display – 16.7 million colors
- 720 Million Bytes (=686MB) HDD
- 8MB RAM, upgradable to 40MB
- VL local-bus video
- Integrated 16-bit Sound Blaster™ compatible sound system
- New enhanced Lithium Ion battery
- Two stacked PC Card slots (two Type II or one Type III)
- AccuPoint™ integrated pointing device
- External 3.5" 1.44MB floppy drive
- 4.8 lbs. – 9.9" x 7.9" x 2.0"
- Optional Port Replicator
- DOS, Windows® for Workgroups, MaxTime® Power Management and Fn-esse™ software
- Toll-free technical support — 7 days a week/24 hours a day

MICROSOFT WINDOWS. READY-TO-RUN

3 YEAR LIMITED WARRANTY

intel inside pentium PROCESSOR

In Touch with Tomorrow

TOSHIBA

Toshiba. The World's Best Selling Portable Computers.

© 1995 Toshiba America Information Systems, Inc. All products indicated by trademark symbols are trademarked and/or registered by their respective companies. The Intel Inside logo is a trademark of Intel Corporation.

Circle 105 on Inquiry Card.

THE NEW PC

Four new technologies will usher your next PC into the '90s

TOM R. HALFHILL

Don't be fooled by fast CPUs: The PC of 1995 is little more than a souped-up IBM AT from 1984, which was a minor improvement over the IBM PC of 1981, which was based on technology from the 1970s that wasn't so hot to begin with. Fortunately, that's all about to change.

Some differences will be externally obvious. Think sleek shapes in black or Caribbean colors. Imagine a collection of compact components and a svelte LCD. Reliable voice recognition is on its way. Cables will give way to infrared beams. And built-in video cameras will let your PC stare back at you.

But to really appreciate the new PC, look under the hood. New technologies will unleash the full potential of modern operating systems and microprocessors, and performance bottlenecks from albatrosses like the ISA bus will disappear. Four of these technologies are available now: Plug and Play (PnP), universal serial bus (USB), unified memory architecture (UMA), and native signal processing (NSP). Together, these technologies will create a more integrated PC that is easier to configure, has significantly faster I/O, uses memory more efficiently, offers more features without extra hardware, and costs relatively less than today's equivalent systems.

The new PC won't make its debut with fanfare and fireworks. Rather, it will evolve steadily over the next five years (see "Old PC vs. New PC," page 55). Here's what to expect during that evolution.

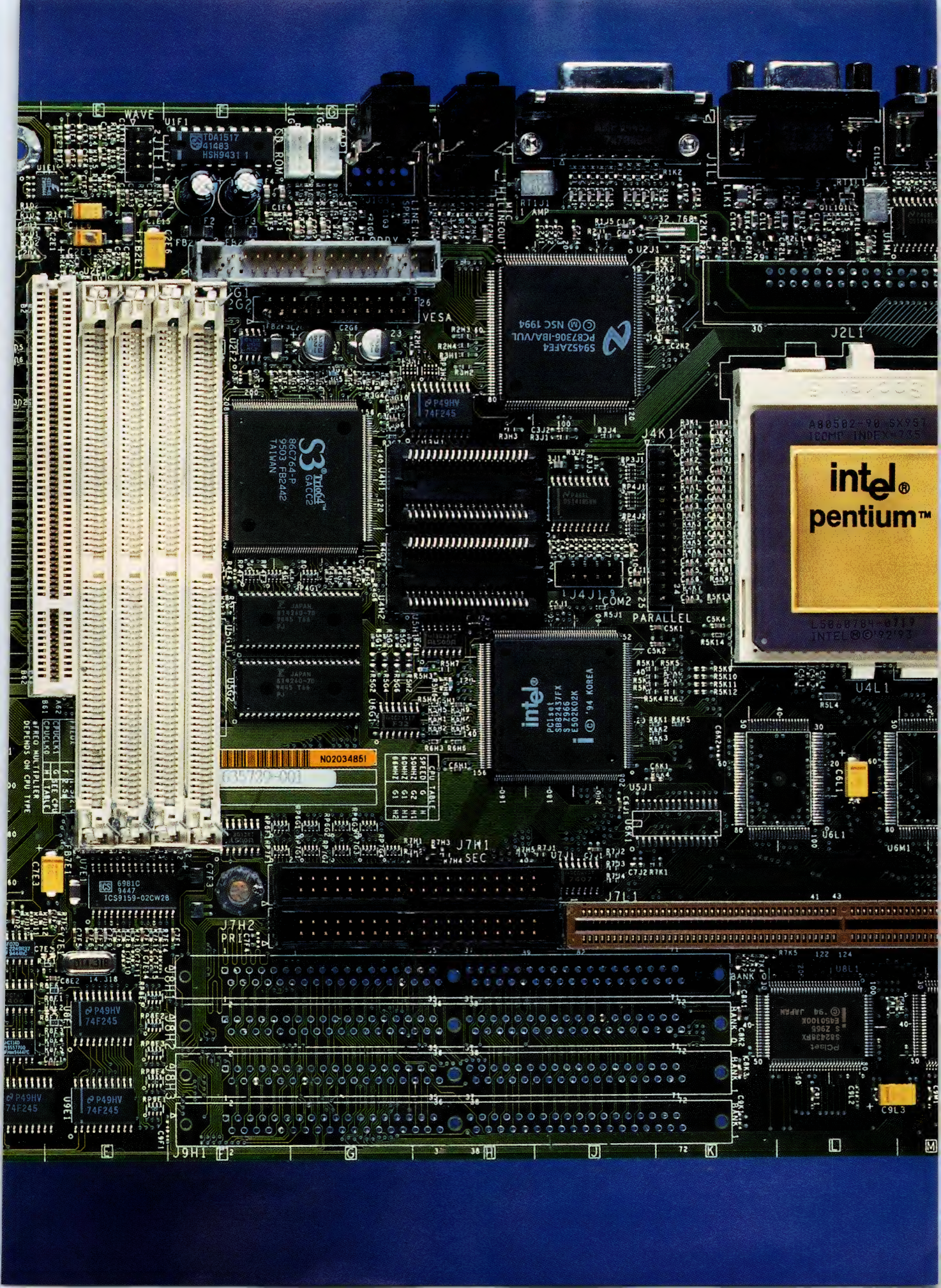
Still Praying for Plug and Play

To see tomorrow's PC, look at today's Macintosh. Macs are far from perfect, but they have pioneered many technologies now coming to PCs. Plug and play has been standard since the 1980s, along with reasonably fast and easy-to-use I/O interfaces such as SCSI and the Apple Desktop Bus (ADB). Numerous Macs employ a unified frame buffer/memory architecture, and Power Macs use NSP for some telephony applications. Moreover, the latest Power Macs are the first mainstream computers to discard their legacy I/O bus (in this case, NuBus) in favor of PCI.

Playing catch-up with Apple, however, is not what PC designers have in mind. The goal is to leapfrog the Mac by adopting superior versions of these technologies whenever possible. Leading the charge are Intel and Microsoft, who may be the only companies powerful enough to direct wholesale changes in the industry. (See the text box "Intel and Microsoft: The Agents of Change," page 58.)

PnP is high on Microsoft's agenda because it's probably the most glaring remaining difference between a PC and a Mac. Although Windows 95 is loaded with PnP features (the Device Manager, dynamic configuration, the Add New Hardware Wizard, and more), they aren't much help if the computer and peripherals don't support PnP as well. Without a PnP BIOS and PnP devices that cooperate with each other and with the OS, painless system expansion will remain just slightly out of reach (see "Transforming the PC: Plug and Play," September 1994 BYTE).

Fortunately for long-suffering PC users, there's strong movement toward PnP. All signs point to wide adoption of PnP throughout the industry in 1996, even if the only mo-


WAVE
TDA1517
41483
HSH9431 1
VESA
S3 Trio64
86C764-P
9503 FB2442
TAIWAN
intel
PCIset
SB82437FX
S.Z966
E502K02K
'94 KOREA
intel
pentium
J2L1
J4K1
COM2
PARALLEL
U4L1
U6L1
U6M1
U5J1
J7H1
SEC
J7H2
PRI
J7L1
J9H1
U8L1
BANK 0
P49HV
74F245
ICS9159-02CW28
14.318
NO2034851

tivation for some vendors is to control their skyrocketing technical-support costs.

All along, Apple has preached the gospel that hardware and software must be tightly integrated. Unfortunately for Apple, it's hard to sell this integration as a feature precisely because it's so transparent. It was easy for Apple to achieve this level of integration because, until recently, the Mac was a closed, proprietary system available only from Apple.

Ironically, as the PC becomes more like a Mac, a Mac may become more like a PC, since Apple now is licensing the Mac OS to clone makers and porting it to the PowerPC common hardware platform.

Port Power

USB represents another major improvement in PC architecture. This external I/O interface will begin appearing in commercial desktop systems next year. If it succeeds, USB could eventually replace a whole slew of ports on today's PCs. This won't happen immediately, because the huge installed base of PCs impedes rapid change. Nevertheless, I/O bottlenecks will push PC vendors to add an interface designed with 1990s technology.

Venerable RS-232 serial ports offer speeds of from 9.6 to 115.2 Kbps, depending on the type of universal asynchronous receiver/transmitter (UART) in the computer. USB's maximum bandwidth is 12 Mbps—although actual data throughput is more like 8 Mbps—including a 1-Mbps subchannel for low-speed devices like a mouse or keyboard. That's enough bandwidth to handle everything from keyboards and mice to video monitors, modems, scanners, printers, ISDN adapters, and MPEG-2 compressed video.

In addition, USB is both asynchronous and isochronous. Isochronous transfers, such as audio and video, get top priority, assuring that time-sensitive data streams are not interrupted. USB lets you daisy-chain up to 127 devices in a tiered-star topology: Each device can house a USB hub to which additional devices can connect. Cable segments can be 5 meters long. It supports hot-plugging, so you can add or remove devices without powering down the computer. If the devices and the OS support PnP, the appropriate device drivers can automatically load and unload.

USB is also cheap to implement. Some of Intel's PCI chip sets will soon include USB logic, so the only additional cost is for the 35-cent external connector. As

ON THE COVER

Now that PC architecture is being overhauled (see main story), how different will your next PC look? Our cover shows three possibilities: The Apple Sweep and IBM Leapfrog are industrial designs, while the Archistrat 4b was scheduled to ship commercially as we went to press. All three are significant because their capabilities, as well as their external design, are made possible by the new technologies being incorporated by the next generation of PCs.

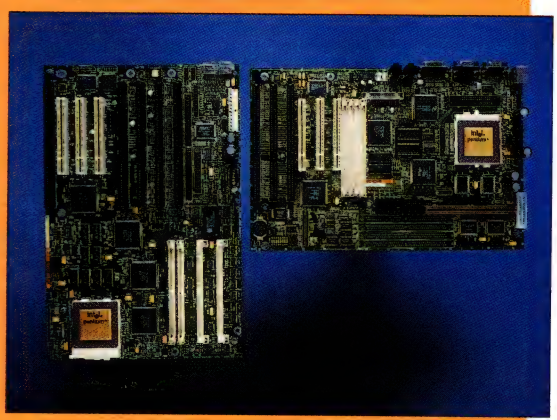
Sweep designer Tim Parsey says the flat-panel display inspired Apple to create a desktop system built around components that are smaller and thinner than conventional PCs, but offer the same computing power as the stacked boxes we're used to working with. Inside the Sweep is a standard motherboard that can house next-generation PowerPC chips. The keyboard tucks away into the horizontal stand. The main vertical segment holds CD-ROM, hard-disk, PC Card, and floppy drives. Built-in audio gets a boost from two tweeters and detached external speakers.

The Leapfrog also uses the LCD to break the bounds of the desktop mold. The portable display panel holds the CPU, as well as the hard-disk, floppy, and PC Card drives. The pen stylus and pen-based software launche applications. For a more traditional desktop unit, attach the LCD panel to the docking station (nicknamed the lily pad), which features a slide-out keyboard.

The Archistrat Systems 4s and 4b computers use a custom connector that sits between a partitioned motherboard and a passive backplane. The architecture lets you mix and match CPUs, I/O subsystems, and other fundamental components to accommodate your needs (for details, see the text box "Coming Soon: Archistrat 4s," on page 60).

Coming Soon

ATX Motherboards



Intel's new ATX motherboard is the first major reengineering of the PC motherboard in a decade. It sets a new standard for motherboard configuration for desktops and mini-towers that improves the component layout. ATX also costs less to manufacture; provides easier access to slots, cables, and bays; reduces noise and power consumption by requiring only one cooling fan and a smaller power supply; and fits existing AT and baby AT cases. It also fits into a new small-footprint case that stacks the rear connectors to save even more space. The ATX will appear in PCs later this year. Contact: Intel, Santa Clara, CA; (800) 538-3373 or (408) 765-8080; http://www.intel.com/pc-supp/platform.html or /motherbd/atx.html. **Circle 1075 on Inquiry Card.**

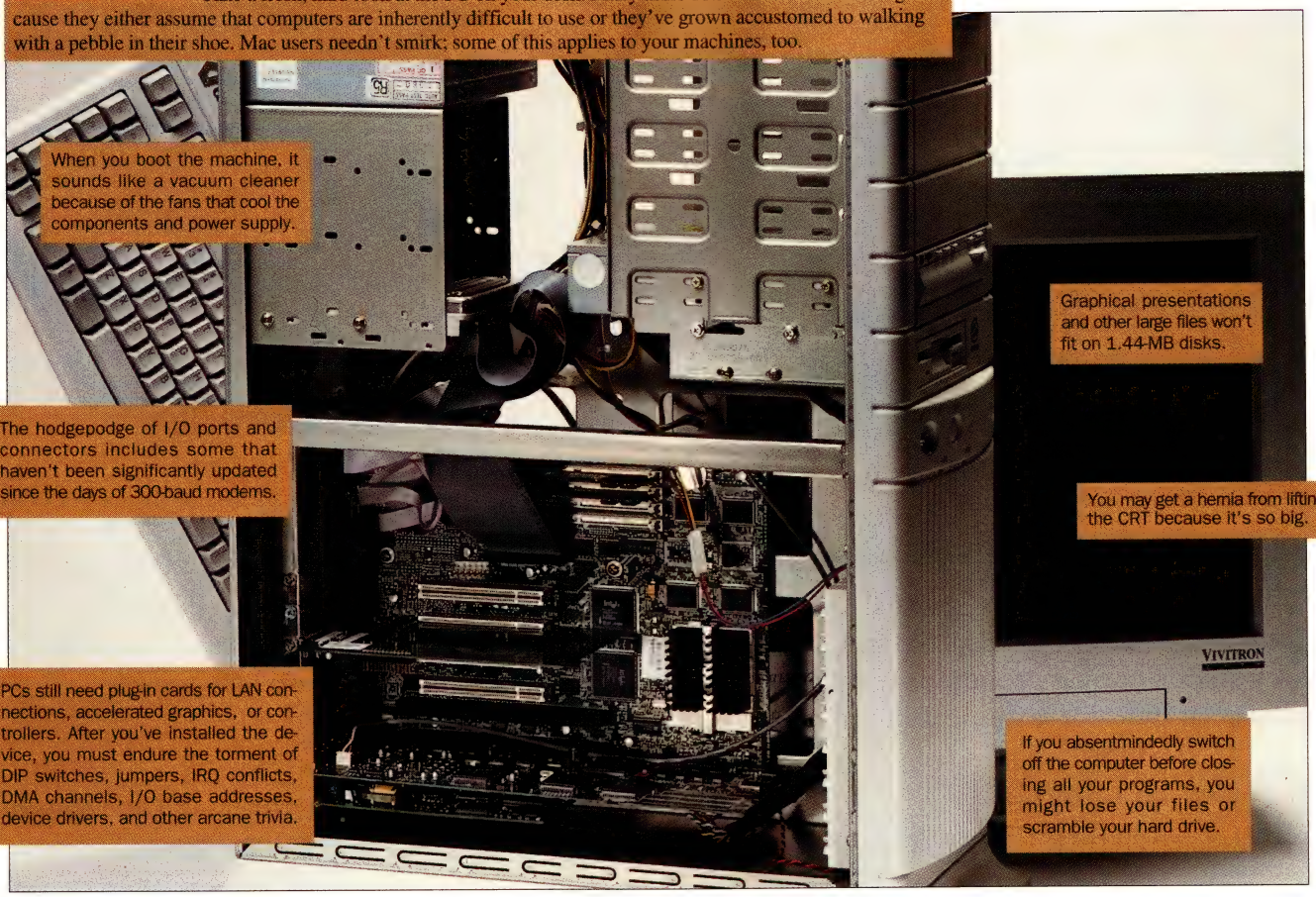
Now Showing

Jabra-Net Telephony

The Jabra-Net $99 package includes Jabra's Ear Phone, AlgoRhythms' PC Phone program, and VocalTec's Internet Phone software that turns your PC into a hands-free telephone that can place global long-distance voice calls over the Internet for the cost of a local call. The Jabra Ear Phone is a clever gadget all by itself—it fits in your ear and picks up your voice with a unidirectional mike concealed in the earpiece. Contact: Jabra, San Diego, CA; (800) 327-2230, (619) 622-0764, or fax, (619) 622-0353; sales@jabra.com; http://www.jabra.com. **Circle 1079 on Inquiry Card.**

OLD PC

Take a fresh, hard look at the PC on your desk. Many users don't notice what's wrong because they either assume that computers are inherently difficult to use or they've grown accustomed to walking with a pebble in their shoe. Mac users needn't smirk; some of this applies to your machines, too.



When you boot the machine, it sounds like a vacuum cleaner because of the fans that cool the components and power supply.

Graphical presentations and other large files won't fit on 1.44-MB disks.

The hodgepodge of I/O ports and connectors includes some that haven't been significantly updated since the days of 300-baud modems.

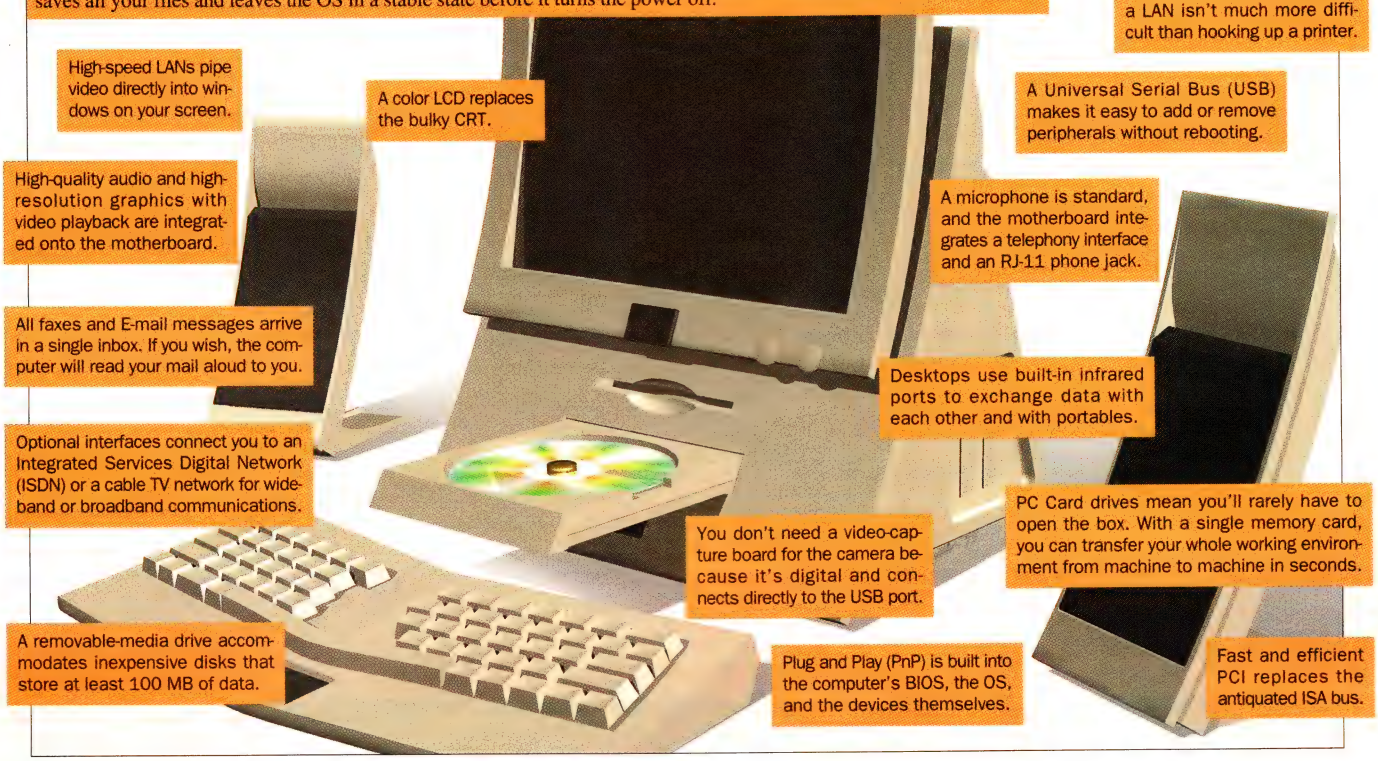
You may get a hernia from lifting the CRT because it's so big.

PCs still need plug-in cards for LAN connections, accelerated graphics, or controllers. After you've installed the device, you must endure the torment of DIP switches, jumpers, IRQ conflicts, DMA channels, I/O base addresses, device drivers, and other arcane trivia.

If you absentmindedly switch off the computer before closing all your programs, you might lose your files or scramble your hard drive.

NEW PC

The new PC of the next two to five years will be much sleeker because the external card bays, USB port, and integrated motherboard devices minimize the need for internal expansion slots. Low-voltage components and advanced power management mean the computer uses less electricity and runs cooler. A software-shutdown feature saves all your files and leaves the OS in a stable state before it turns the power off.



Networking built into hardware and the OS means setting up a LAN isn't much more difficult than hooking up a printer.

High-speed LANs pipe video directly into windows on your screen.

A color LCD replaces the bulky CRT.

A Universal Serial Bus (USB) makes it easy to add or remove peripherals without rebooting.

High-quality audio and high-resolution graphics with video playback are integrated onto the motherboard.

A microphone is standard, and the motherboard integrates a telephony interface and an RJ-11 phone jack.

All faxes and E-mail messages arrive in a single inbox. If you wish, the computer will read your mail aloud to you.

Desktops use built-in infrared ports to exchange data with each other and with portables.

Optional interfaces connect you to an Integrated Services Digital Network (ISDN) or a cable TV network for wideband or broadband communications.

PC Card drives mean you'll rarely have to open the box. With a single memory card, you can transfer your whole working environment from machine to machine in seconds.

You don't need a video-capture board for the camera because it's digital and connects directly to the USB port.

A removable-media drive accommodates inexpensive disks that store at least 100 MB of data.

Plug and Play (PnP) is built into the computer's BIOS, the OS, and the devices themselves.

Fast and efficient PCI replaces the antiquated ISA bus.

Go Above and Beyond Your Bottom Line

The 1995 Business Week Forum of Financial Directors

The Financial Director: Sentinel of Value

There's a new breed of Financial Director. One who's looking beyond corporate finance and taking charge of overall corporate strategy. Join *Business Week* and the Financial Directors of Europe's business community for face-to-face interaction and discussion on how today's Financial Director is doing more than ever to improve the bottom line.

17-18 October 1995
The Landmark London
London, U.K.

In association with:
eunetcom
Ohio Department of Development
Thomas Group, Inc.
Union Bank of Switzerland
Unisys Corporation

Featured Speakers:
Peter D. Sutherland, former Director General, GATT/WTO
S. B. Birkenhead, group finance director, National Power Plc.
Ray Stewart, Chief Financial Officer, Matav
Sir David Frost OBE, Broadcaster/Interviewer

To register for the Europe Forum of Financial Directors, call +1(212) 512-2184, fax your response to +1(212) 512-6281, or mail this registration form to:

Ann McKenna
Business Week Executive Programs
1221 Avenue of the Americas, 36th floor
New York, NY, U.S.A. 10020-1095

FEE: US $950
☐ **Check enclosed**
☐ **Bill me**

Bill my: ☐ **American Express** ☐ **MasterCard** ☐ **Visa**

ACCOUNT NUMBER _____ EXPIRATION DATE _____

SIGNATURE _____

BYTE

NAME _____

TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ STATE/COUNTRY _____ ZIP/POSTAL CODE _____

TELEPHONE _____ FAX _____

PRIMARY BUSINESS _____ ANNUAL REVENUE (US$) _____

BusinessWeek

EXECUTIVE PROGRAMS

Beyond news. Intelligence.

Recognita Plus 3.0

Greater recognition

Key features of this new release:

- Robust multilingual and font-independent recognition
- Speed, accuracy and good proofing tools maximise through-put
- Comfortable one-button operation for standard jobs
- High-volume processing options for power users

Further benefits

- Input from file or any of over 140 desktop scanner models (plus the TWAIN standard)
- Greyscale scanning, auto-deskew and image rotation ensure best quality input
- Dictionaries aid recognition and proofing in a wide range of languages
- New WYSIWYG text editor with verification from image
- Precise control over the amount of format retention
- Output to over 50 word processor, spreadsheet, database and DTP programs

Floating or fixed toolbars for ease of use. Split-panel document windows link text and image seamlessly. Text export by file, drag-and-drop (OLE 2.0) or by direct connection to your favourite MS Windows applications.

Self Assertion Technology tackles the difficult characters by thinking twice before it decides. Characters up to 48 pt. can be recognized, as can draft dot-matrix and fax output — and all that in up to eighty languages.

Training is useful for severely degraded documents or highly stylised typefaces. In 3.0, it can be done after recognition when it's clear whether, what and how much to train. Training is applied to the document already recognized and can be saved for future use.

No longer just an OCR, but a total recognition package — separate modules can be invoked for checkbox or barcode zones, or ones containing hand printed numerals. Over 140,000 Recognita users world-wide have already discovered the productivity gains to be made by automated data entry. It's time you joined them!

RECOGNITA

RECOGNITA Rt.
Márvány u.17,
H-1012 Budapest, Hungary
Phone: (36-1) 201-8925
Fax: (36-1) 201-7607
Letters: P.O.Box 55,
H-1251 Budapest

RECOGNITA Büroautomatisierung GmbH
Gohlis Arkaden/Turm B49 Lützowstr. 11-13.
D-04155 Leipzig, Germany
Phone: (49-341) 209-635
Fax: (49-341) 281-643

RECOGNITA Corp. of America
1156 Aster Avenue, Suite F,
Sunnyvale, CA 94086, USA
Phone: (1-408) 241-5772
Fax: (1-408) 241-6009

Circle 565 on Inquiry Card (RESELLERS: 566).

other chip makers incorporate USB into their products, the new serial bus will become a standard feature on new PCs. Inexpensive USB might also encourage engineers to include USB hub logic in external peripherals, which would provide for extra USB ports for daisy-chaining additional devices. Cables have only four wires, allowing compact connectors roughly as wide as a staple. Small size is important for notebooks, palmtops, and downsized desktop PCs. For all these reasons, USB appears to be edging out alternative I/O interfaces that have been proposed as the next-generation standard, including GeoPort, Access.bus, FireWire, and SCSI.

GeoPort is a slightly enhanced version of the 12-year-old RS-422 serial ports on Macs. Apple already equips Power Macs with GeoPorts to provide telephony functions. For instance, the GeoPort Telecom Adapter connects a phone line to the Mac while the PowerPC processor emulates a fax modem. Apple formed a consortium called Versit with IBM, AT&T, and Siemens to promote GeoPort as an industry standard, and it will be available for PCs in the form of PCI and PC Cards (formerly PCMCIA). However, GeoPort's relatively slow throughput of 2 Mbps probably eliminates it from contention as the next-generation external I/O port for PCs.

Access.bus is even slower than GeoPort—its data rate is only 100 Kbps. Invented by Philips, it was never intended to be a general-purpose high-speed interface. Instead, it was designed for low-speed peripherals, such as keyboards and pointing devices. It's also used for the Video Electronic Standards Association (VESA) Display Data Channel (DDC), a control interface for video monitors that Microsoft recommends for future PCs. But even though Access.bus costs less to implement in peripherals and on motherboards, its inability to support a wide range of peripherals puts it at a disadvantage with USB.

FireWire—officially known as IEEE-P1394—is backed mainly by Apple, with chip support from Texas Instruments. It has significant advantages over USB. FireWire's data rate is 100 Mbps and will soon be extended to 200 Mbps and 400 Mbps. Also, FireWire is being promoted as a standard interface for consumer video devices, such as digital VCRs and cameras. If widely adopted, it could accommodate much faster peripherals than USB and provide the crucial digital link between personal computers and future con-

INTEL AND MICROSOFT: THE AGENTS OF CHANGE

Finding faults in the PC is not the problem; fixing them is. The basic architecture of PCs remained stagnant for a decade because IBM lost control of the standard in the 1980s and nobody else was strong enough to claim the position of top dog.

Even the leading clone vendors like Compaq, Packard Bell, Gateway 2000, and Dell don't wield enough influence to force fundamental changes. Besides, profit margins are too slim to fund the costly R&D that's required to make it happen.

Result: a power vacuum that has attracted Intel and Microsoft. Both industry giants are frustrated by the problems of the PC system architecture. Intel wants to keep the PC market growing in order to sell more chips; Microsoft wants to ensure that PCs will be powerful enough to support its future ambitions for Windows. Their motivations are self-serving, but in the end, the whole industry will benefit if the result is more efficient systems.

Intel built a lavish R&D facility in Hillsboro, Oregon, known as the Intel Architecture Lab (IAL). In effect, IAL is playing the same R&D role for penny-pinching clone vendors that Bell Labs used to play for the regional Bell telephone companies.

IAL is responsible for inventing, refining, or promoting technologies that either fix problems in the PC architecture or create new applications that accelerate demand for PCs. These technologies and products include PCI, Universal Serial Bus (USB), Plug and Play (PnP), Telephony API (TAPI), Display Control Interface (DCI), Native Signal Processing (NSP), Digital Simultaneous Voice & Data (DSVD), ATX motherboards, Indeo video compression, ProShare videoconferencing, and CNN at Work.

Microsoft has been playing a key role in developing such hardware/software technologies as PnP, USB, TAPI, and DCI. Recently, Microsoft has been going even further. In a bold imposition for a software company, Microsoft sponsors a yearly confab (the Windows Hardware Engineering Conference, or WinHEC) and publishes an inch-thick manual ("Hardware Design Guide for Windows 95") that instructs hardware companies how to design their future PCs and peripherals. To win the coveted Windows 95 logo, system vendors must follow Microsoft's specifications, right down to putting little icons on the back of the computer so users can tell the mouse port from the keyboard port.

It's hard to imagine a "WordPerfect Hardware Engineering Conference" or a "Hardware Design Guide for After Dark," but then, other companies are not Microsoft. While programmers at other software companies write to the hardware, Microsoft is redefining the hardware around Windows.

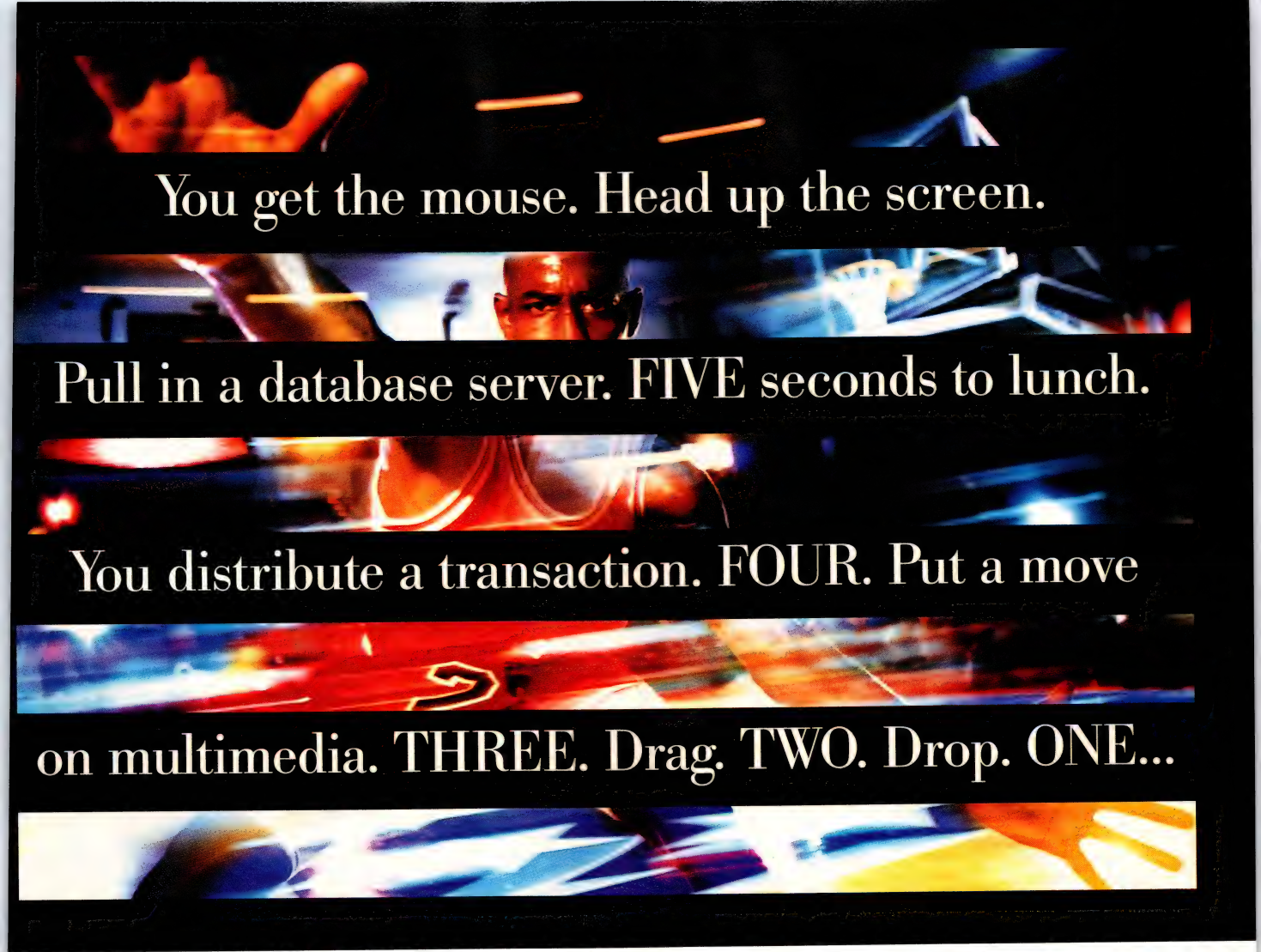
Of course, Intel and Microsoft don't always see eye to eye—they've split over such things as DCI and NSP—but in general, they share the same goal: Fix the PC.

Coming Soon

NeoMagic MagicGraph NM2070

Highly integrated components offer more functionality while cutting costs and reducing power consumption. NeoMagic's new MagicGraph NM2070 is a single chip that replaces three or four separate chips in notebook systems, integrating a Super VGA graphics accelerator, a 1-MB frame buffer, a 128-bit memory interface, a RAM digital/analog converter (RAMDAC), an LCD controller, and PCI/VESA local-bus interfaces. The first notebooks with the MagicGraph NM2070 will be announced this fall. Contact: NeoMagic, Santa Clara, CA; (408) 988-7020, or fax (408) 988-7032; info@neomagic.com; http://www.rahul.net/neomagic.

Circle 1076 on Inquiry Card.



Yeeesssss. It's all over, baby.

It's easy to see why nothing propels you into the big leagues of object-oriented programming like our new VisualAge™ C++ version 3.0.

It transcends mere GUI builders. ***Can your software do this?*** This fully integrated development environment lets you generate tight, fast client/server applications with point-and-click ease and efficiency.

A simple drag-and-drop incorporates the truly scalable capabilities of a vast library of pre-built Open Class objects, which means you can create distributed client/server apps quickly. And with Open Class and C++ compilers for OS/2®, Sun™ Solaris™, OS/400®, AIX®, and MVS, deploying your new object-oriented apps across multiple platforms is really easy. We thought that new features like these would excite you. *Infoworld* agreed, and has called our new VisualAge C++ "object reusability at its finest" and "a masterpiece of visual programming."†

True OO client/server development with VisualAge C++ for OS/2. It could be the best move you make.

Get a Developer's Kit including OS/2 Warp and a CD featuring an evaluation copy of DB2® v2 when you buy VisualAge C++ for OS/2.* Call your authorized IBM reseller or 1 800 3IBM-OS2, Dept. SA034.

IBM®
Solutions for a small planet.™

*This is a limited-time offer. To receive your Developer's Kit, simply complete and return the VisualAge C++ registration card by December 29, 1995. OS/2 Warp will be shipped on CD ROM only. In Canada, please call 1 800 IBM-CALL, ext. 8012. Outside North America, please contact your local IBM office. VisualAge C++ for OS/400 will be available in 4th Qtr., 1995. The IBM software home page is located at http://www.software.ibm.com. IBM, OS/2, DB2, OS/400 and AIX are registered trademarks and VisualAge is a trademark of International Business Machines Corporation. All other trademarks are the property of their respective owners. †*Infoworld* review, 5/8/95. © 1995 IBM Corporation. All rights reserved.

sumer electronics products.

But because FireWire logic isn't inherent in chip sets and peripherals, it costs more to implement than USB. Apple has yet to build FireWire into any of its Macs, and it's even less likely to be integrated in PCs. It will probably be available on a PCI board for those who want it in 1996.

SCSI remains a contender. When Apple standardized on SCSI in 1986, it spawned a healthy market for SCSI-based scanners, hard disks, CD-ROM drives, and other peripherals. When PC users began upgrading their systems with CD-ROM drives, SCSI adapters zoomed in popularity. Today, SCSI is an important cross-platform interface standard that's also found on some Unix workstations. SCSI-2 introduced faster throughput in two flavors. Fast SCSI-2 doubled original SCSI speeds to 10 Mbps on an 8-bit bus. Wide SCSI-2 can use a 16- or 32-bit bus for throughput of 20 Mbps. Fast and Wide SCSI achieves speeds of 40 Mbps.

But SCSI has several problems. Current implementations support only eight devices per chain, far fewer than rival serial interfaces. Each end of the daisy chain must be terminated, a prime cause of configuration woes. Each device requires a unique ID number, and some devices don't support all IDs. Because SCSI is a parallel interface, the connectors are relatively large, the cables are thick and expensive, and longer cable lengths are unreliable. SCSI doesn't allow hot-plugging, either.

Work is progressing on new versions of SCSI to address these flaws. The proposed SCSI-3 standard calls for more than eight devices per chain, automatic ID assignment, and faster throughput. There are even proposed serial versions of SCSI-3 that could use fiber-optic cables or gallium arsenide technology to attain speeds as high as 1 Gbps. So SCSI still has a bright future as the high-speed alternative in applications that need peripherals that would quickly saturate the capacity of USB.

RAM Reunification

Since the original IBM PC of 1981, almost all PCs have maintained separate memory for their frame buffer, the block of memory in which the screen image is mapped. This wasn't a problem in the days of monochrome character-mapped video because the frame buffer could be as small as 2 KB. But modern GUIs have created demand for high-resolution, true-color bit-mapped screens. A 640- by 480-

Coming Soon

Archistrat 4s

One of the most unconventional system architectures seen in recent years is coming in a new line of servers and desktop systems from Panda Project, a start-up based in Boca Raton, Florida. Panda partitions the traditional motherboard into three independent boards connected to a passive backplane by a proprietary high-speed interface. By separating the CPU, I/O, and main memory into modular subsystems, Panda says it will offer a level of upgradability and CPU independence unmatched by conventional designs.

The CPU board includes the microprocessor, secondary cache, primary PCI bus, and related control logic. (For now, Panda is supporting three CPU architectures—Intel x86, DEC Alpha, and soon IBM/Motorola PowerPC—but others could be added in the future.) The I/O board includes system I/O interfaces, such as ISA, SCSI, or a bridge to a second PCI bus. The memory board contains all the DRAM for main memory. These subsystems connect to the backplane with Panda's high-density Compass interface, a panel of 18 152-pin connectors.

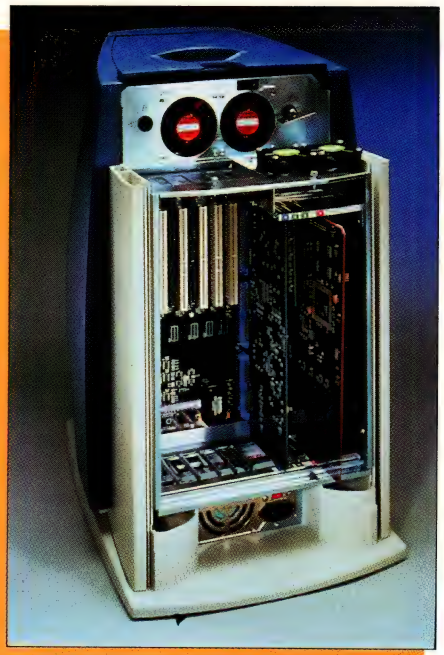
This architecture allows users or resellers to snap together their own systems with the CPU, I/O interfaces, and memory they want.

Panda's first system, the Archistrat 4s server, is expected to debut this fall at $10,490. That's for a 100-MHz Pentium with 32 MB of RAM and a 1-GB hard drive. Alpha CPU boards are planned for later this year, and PowerPC boards based on the PowerPC common hardware platform are expected in mid-1996.

Archistrat's modularity lets you start with a Pentium and switch to an Alpha, or vice versa.

"It's intellectually satisfying," says Eric Lewis, an analyst at International Data Corp. (Mountain View, CA). "But I don't think most companies are really that interested in switching [CPU] architectures, because then you've got to revamp all your software, too. It seems like a fairly small market."

It's also a market pursued by DeskStation Technologies, which last year introduced a motherboard called the UniFlex. The UniFlex segregates the CPU on a daughtercard that supports either an Alpha 21164 or a Mips-compatible R4600 Orion. (Future versions may also support the Alpha 21164A and the PowerPC 620.) DeskStation puts the UniFlex motherboards into its high-end PCs for Windows NT.



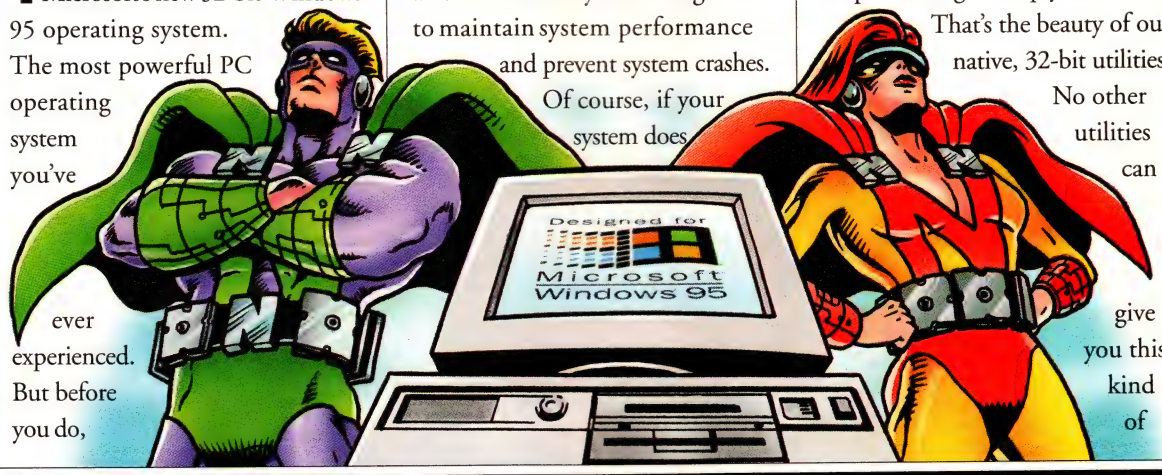
Panda goes further than DeskStation by partitioning the I/O and memory subsystems as well. Conceivably, you could swap out the memory board to take advantage of faster DRAM technology or change the I/O board if a new bus standard supersedes PCI.

DeskStation's vice president of engineering, Blaise Fanning, says Panda's design is philosophically sound but unnecessary in practice, because memory and I/O technologies don't advance as quickly as CPUs. Also, he adds, by the time you upgrade all the subsystems, you might as well purchase a whole new computer: "The only investment you're really preserving is the backplane."

Previous passive-backplane designs have also been criticized for their high cost or inadequate bandwidth. Panda says its Compass technology solves these problems. The Compass connectors carry about 650 signals between the CPU and the backplane, but they cost only five cents per mated pair, according to Bruce Smith, Panda's vice president of engineering.

BYTE was unable to test a production sample of the Archistrat 4s in time for this article. If nothing else, Panda's modular approach to motherboards is an interesting twist on the system architecture of PCs. Contact: Panda Project, Boca Raton, FL; (800) 892-2892, (407) 994-2300, or fax (407) 994-0191; sysinfo@archistrat.com. **Circle 1083 on Inquiry Card.** DeskStation Technologies, Lenexa, KS; (800) 793-3375, (913) 599-1900, or fax (913) 599-4024 http://www.dti.com; sales@dti.com. **Circle 1084 on Inquiry Card.**

You're ready to make the move to Microsoft's new 32-bit Windows 95 operating system. The most powerful PC operating system you've ever experienced. But before you do,



background, monitoring your system and automatically launching tools to maintain system performance and prevent system crashes. Of course, if your system does

Norton Utilities for Windows 95 keeps running to help you recover. That's the beauty of our native, 32-bit utilities. No other utilities can give you this kind of

NORTON UTILITIES PROVIDES THE ONLY AUTOMATIC DATA RECOVERY AND CONTINUOUS SYSTEM PROTECTION FOR WINDOWS 95.

upgrade your utilities to Norton Utilities® for Windows 95.

IT'S A 32-BIT WORLD OUT THERE.

You already know Norton Utilities is the best set of tools for system protection, hard disk optimization and data recovery.

What you may not realize is that your current 16-bit utilities won't run under Windows 95.

And the simple utilities found in Windows 95 itself don't offer sufficient data protection for life in a 32-bit world.

Which is why you need the new Norton Utilities for Windows 95.

The first thing Norton Utilities for Windows 95 will do for you is tune up your system for Windows 95 by optimizing your hard drive and cleaning out all of the files you no longer need.

Then Norton Utilities runs in the background, monitoring your system and automatically launching tools to maintain system performance and prevent system crashes. Of course, if your system does crash or you accidentally erase a file, Norton Utilities for Windows 95 gives you the data recovery tools users have relied on from day one.

Even if other applications crash, continuous, real-time protection and data recovery in the brave new world of Windows 95.

NORTON UTILITIES FOR WINDOWS 95

PRE-INSTALLATION TUNE-UP
Frees up disk space and provides a comprehensive pre-installation physical.

NORTON SYSTEM DOCTOR
Continuously monitors all vital resources and data integrity. Alerts you to impending disaster and recommends action or fixes problems automatically.

NORTON DISK DOCTOR®
Automatically diagnoses and repairs file system problems using the speed and safety of 32-bit technology.

UNERASE®
100% protection of erased files. The new wizard-like interface leads you through file recovery step by step.

SYSTEM INFORMATION
Diagnoses potential conflicts and configuration problems with detailed system information and performance testing.

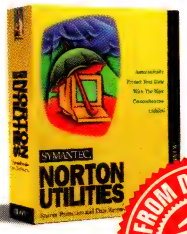
NORTON SPEED DISK™
Automatically optimizes drives and reduces future fragmentation using 32-bit technology.

PROTECT YOUR DATA FROM DAY ONE.

And like every software product from Symantec, Norton Utilities for Windows 95 comes with a full sixty-day money-back guarantee.

So you've got nothing to lose. Except your data. Get your trade-up edition of Norton Utilities for Windows 95 today.

If you own Norton Utilities, Norton Desktop for Windows or PC Tools, get your $59.95 trade-up edition of Norton Utilities for Windows 95 today. To purchase, visit your software store or call us at 1-800-450-9760, ext. 9AP9.*



SYMANTEC.®

*Trade-up editions will run only when specified Symantec and Central Point products are already installed. Check with your software store for qualifying versions. Price does not include shipping & handling or any applicable sales tax. Symantec, Norton Utilities, Norton Disk Doctor and UnErase are registered trademarks and Speed Disk is a trademark of Symantec. All other brand names or trademarks are the property of their respective owners. ©1995 Symantec Corporation. All rights reserved. Visit us on the Internet at http://www.symantec.com. In Canada, call 1-800-365-8641. In Australia, call 2-879-6577. In Europe, call 31-71-353111.

Circle 110 on Inquiry Card.

pixel screen with 8-bit color requires a frame buffer of 300 KB; 1024 by 768 pixels with 24-bit color requires 2.25 MB.

It's not just an issue of more memory. A dedicated frame buffer is fixed in size—no matter which screen mode you're using, the frame buffer always contains enough memory to accommodate the highest resolution and color depth it supports. Your software can't use the leftover memory. Because of the way DRAM is packaged and configured in graphics subsystems, megabytes of memory can go to waste.

UMA unifies the frame buffer with main memory. By allocating just enough RAM to handle the current screen mode, UMA frees up memory for other purposes. Eliminating the dedicated frame buffer is expected to trim about $50 off the cost of a typical system. Chip sets that support UMA are coming from Weitek, Opti, VLSI, Chips & Technologies, Intel, and Cirrus Logic. PCs with UMA should appear this year or early in 1996.

In all likelihood, UMA will come first to low-end PCs. High-end systems will probably avoid it, because UMA sacrifices performance when the CPU and the graphics controller try to access main memory at the same time. Cirrus Logic estimates the performance hit is about 5 percent for a 16-MB system with a secondary CPU cache, and 10 percent to 15 percent for cacheless systems. An 8-MB system would suffer more. Reduced performance is why Apple, which has used a similar scheme for years, still retains dedicated frame buffers in some Macs.

Mixed Signals

Still up in the air is how PCs will handle signal-processing tasks, such as audio, video, and telephony. This question pits Intel against some other chip makers and against Microsoft.

PCs have taken advantage of general-purpose digital signal processors (DSPs) for years. In 1992, Atari introduced the Falcon030, the first personal computer with a general-purpose DSP. Then Apple built AT&T's 3210 DSP into the Quadra 660AV and 840AV Macs. IBM and Texas Instruments announced the low-cost MWave DSP for PCs. And Microsoft said Windows 95 would have a DSP Resource Manager Interface (RMI), an API layer designed to insulate programmers from DSP-specific features.

But the trend was derailed. First Apple, then Intel, claimed its latest CPUs could handle many DSP tasks natively.

Now Showing

Sceptre Desktop LCDs

It'll probably be 10 years before color LCDs challenge the dominance of CRTs on desktops, but you don't have to wait that long—if you're willing to pay. Active-matrix and dual-scan color LCDs for desktop PCs are here now. Sceptre's LCD monitors range in size from 10.3 to 11.4 inches (diagonal), are less than 2 inches thick, and weigh less than 3 pounds. Prices range from $1595 to $2395. Contact: Sceptre Technologies, City of Industry, CA; (800) 788-2878, (818) 369-3698, or fax (818) 369-3488. **Circle 1080 on Inquiry Card.**

Now Showing

Connectix QuickCam

Whiteboarding and document-sharing are the most useful commercial applications for videoconferencing, but visual images will find a place, too. The Connectix QuickCam (about $99) transmits a low-resolution gray-scale image and plugs directly into a parallel port on a PC or a serial port on a Mac, so it doesn't need a video digitizer. In five years, little cameras like this could be as common in PCs as built-in microphones are in today's Macs. Contact: Connectix, San Mateo, CA; (800) 950-5880, (415) 571-5100, or fax (415) 571-5195; connectix@aol.com. **Circle 1082 on Inquiry Card.**

Coming Soon

120-MB Disks

For multimedia files and graphics, 1.44-MB floppy disks just don't cut it anymore. Compaq, 3M, and Matsushita are reviving the Floptical concept: an optically indexed magnetic disk. The disks will hold 120 MB and work five times faster than regular floppy disks. The new drives will also read and write 1.44-MB and 720-KB disks. Compaq hopes to ship its PCs with these drives in 1996. Contact: Compaq Computer, Houston, TX, (800) 345-1518 or (713) 378-8820, fax, (713) 378-1442; http://www.compaq.com.

Windows 95 is here. And it's really terrific.

Except for one thing: it doesn't include any anti-virus protection. And your old anti-virus software won't work in Windows 95 either. But thousands of old viruses will.

So that leaves you with a choice. Do nothing and hope you never come across an infected floppy or download an infected file. Or buy a new anti-virus software product that can work in this new environment.

But which anti-virus product should you buy? Norton AntiVirus® for Windows 95.

from the viruses everybody already knows about. But also from the new viruses created every day.

What's more, you get all this ironclad protection without a host of long annoying disruptions to your work.

DETECTION, PREVENTION, DESTRUCTION. IF YOUR ANTI-VIRUS SOFTWARE DOESN'T HAVE ALL THREE, YOU'LL BE COMPLETELY EXPOSED TO VIRUSES IN WINDOWS 95.

NCSA CERTIFIED SO YOU CAN REST EASY.

Norton AntiVirus for Windows 95 is NCSA certified to detect 100% of the viruses found in circulation. And recent independent tests* conclusively demonstrate that Norton AntiVirus for Windows 95 detects and destroys as many or more known viruses as any other anti-virus product around.

But our virus protection doesn't stop there. Norton AntiVirus for Windows 95 also protects you from new, unknown viruses. Thanks to a unique virus detection technology that allows us to spot any suspicious activity, no matter where it's lurking.

So your system is safe. Not just

Because Norton AntiVirus for Windows 95 scans files fast. Even compressed files.

And Norton AntiVirus works in the background, continuously monitoring file access and usage. So it can stop viruses in their tracks. Which means you don't have to worry every time you put a floppy in your disk drive.

Designed for Microsoft® Windows®95

THE NO RISK ANTI-VIRUS SOLUTION.

Needless to say, Norton AntiVirus for Windows 95 comes with our standard sixty-day money-back guarantee.

So why gamble on running Windows 95 without complete virus protection? Get your trade-up edition of Norton AntiVirus for Windows 95 today.

NORTON ANTIVIRUS FOR WINDOWS 95

WINDOWS 95 COMPLIANT
Full 32-bit application. Supports long file names and Universal Naming Conventions.

AUTOMATIC BACKGROUND MONITORING
Virtual device driver unobtrusively checks for viruses in the background. Ensures backups and files transferred are virus-free.

FAST SCANNING
Provides ironclad virus protection without affecting productivity. Scans even compressed files fast.

EXCLUSIVE VIRUS SENSOR
Provides continuous, transparent protection against new, unknown viruses.

NCSA CERTIFIED
Detects 100% of viruses found in circulation.

TRADE-UP EDITION NOW ON SALE.

*If you own Norton AntiVirus, Central Point Anti-Virus, Norton Desktop for Windows, or PC Tools, get your $29.95 trade-up edition** of Norton AntiVirus for Windows 95 today. McAfee VirusScan and Dr. Solomon's Anti-Virus owners also eligible. To purchase, visit your software store or call us at 1-800-450-9760 ext. 9AP11.*

FROM DAY ONE NORTON FOR WINDOWS 95

SYMANTEC.

*Independent tests conducted by NCSA and VSUM, July 1995. **Trade-up editions will run only when specified Symantec, Central Point, McAfee or Dr. Solomon's products are already installed. Check with your software store for qualifying versions. Price does not include shipping & handling or any applicable sales tax. Symantec and Norton AntiVirus are registered trademarks of Symantec Corporation. All other brand names or trademarks are the property of their respective owners. ©1995 Symantec Corporation. All rights reserved. Visit us on the Internet at http://www.symantec.com. In Canada, call 1-800-365-8641. In Australia, call 2-879-6577. In Europe, call 31-71-353111.

Circle 111 on Inquiry Card.

Apple's GeoPort Telecom Adapter eliminates the need for a modem by connecting the Mac directly to a phone line while using the CPU to emulate a modem in software.

Intel is carrying the concept even further by defining an NSP reference platform for PC vendors and extending the functions to include wave-table audio and software-only video playback. Instead of handing off those functions to dedicated chips and special hardware, Intel's NSP approach uses the CPU to perform audio and video tasks. Intel has demonstrated a 90-MHz Pentium system that uses NSP to display full-motion video in two separate windows while playing eight independent audio tracks.

Partly for these reasons, Microsoft dropped RMI out of Windows 95 and turned it over to Spectron Microsystems, which makes SPOX, a real-time DSP kernel. The lack of a DSP API built into the industry's leading OS is a setback to the widespread integration of DSPs.

In the view of Compaq and other systems vendors, NSP is a cost-effective technology for delivering speech, audio, and other multimedia functions to the business market. But not everyone is ready to shelve DSPs. "The functions that NSP can provide by using the host [CPU], a few dollars' worth of hardware can provide," says Raphael Mehrbians, a senior product manager at Cirrus Logic.

Also, some of that extra hardware is needed anyway, even with NSP. For backward compatibility with DOS programs, PCs need a Yamaha OPL-3 sound chip. The Pentium's wave-table sounds won't be heard unless there's a standard audio codec chip, such as a Crystal Semiconductor 4232. And even though a Pentium can handle such modem functions as data compression and communications protocols, DSP promoters like TI question whether the best use for a high-end CPU is to emulate the modem's data pump.

So general-purpose DSPs may yet appear on PC motherboards, or perhaps be integrated in future CPUs, just as FPUs were. Intel is known to be developing a "multimedia Pentium" (code-named the P55C) for release in 1996. It is expected to add new instructions for signal processing, but at press time details were not available. It may have a multiply-accumulate function or special instructions for decoding MPEG video—a feature introduced last year in the UltraSPARC processor from Sun Microsystems (Mountain View, CA).

Now Showing

Integrated Telephony

Built-in telephony is now standard in desktop PCs from several vendors, most notably AT&T, Compaq, and Packard Bell. Typically, these PCs come with the hardware and software required to work as speakerphones, answering machines, voice mailboxes, and fax machines (with fax-on-demand).

Now Showing

Intergraph TD/TDZ Workstations

Desktop PC Cards allow easy plug-and-play expansion without opening the system, and you can share cards with mobile computers. Contact: Intergraph Computer Systems, Huntsville, AL; (800) 763-0242, (205) 730-5441, or fax (205) 730-6188; http://www.intergraph.com/ics. **Circle 1077 on Inquiry Card.**

Where to Find

Apple Computer
One Infinite Loop
Cupertino, CA
(800) 776-2333
(408) 996-1010
fax: (408) 974-6412
http://www.apple.com

Cirrus Logic
Fremont, CA
(510) 623-8300
fax: (510) 226-2240

Intel
Santa Clara, CA
(800) 538-3373
(408) 765-8080
http://www.intel.com/pc-supp

Microsoft
Redmond, WA
(800) 426-9400
(206) 882-8080
fax: (206) 936-7329
http://www.microsoft.com

Spectron Microsystems
Santa Barbara, CA
(805) 968-5100
fax: (805) 968-9770
info@spectron.com
http://www.dialogic.com/spectron

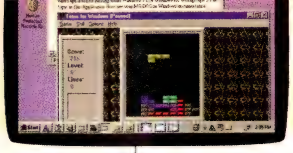
Texas Instruments
Dallas, TX
(800) 848-3927
(214) 995-2011
fax: (214) 995-4360
http://www.ti.com

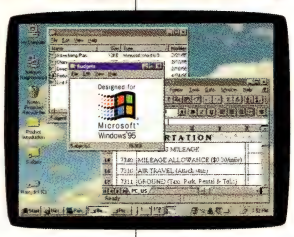
Versit
(800) 803-6240
(201) 327-2803
fax: (201) 327-4981
info@versit.com
http://www.versit.com

False starts and growth spurts will buffet the PC industry as it juggles the conflicting issues of cost, performance, and compatibility. Yet change is essential as the competition for desktops becomes fiercer. By mid-1996, expect systems that support the PowerPC common hardware platform, which is backed by IBM, Motorola, and Apple, and designed with the benefit of hindsight.

When PCs were primarily used for word processors, spreadsheets, and databases, the original IBM system architecture was adequate. But multimedia and richer data types have exposed shortcomings in PCs. For the last few years, the industry has been patching the old architecture to keep it competitive. Now the architecture is finally getting the overhaul it really needs. ■

Tom R. Halfhill is a BYTE senior news editor based in San Mateo, California. You can reach him on the Internet or BIX at thalfhill@bix.com.





Congratulations! You're the proud owner of Microsoft's Windows 95 operating system. Working on a PC has never been easier.

Now try these ten easy exercises and see how you can work even better and faster in Windows 95 with the all-new Norton Navigator.™

CLICK. CLICK. CLICK. CLICK.

1. First, copy a file from one directory to another. Okay, now copy another file. On average, it takes about eleven steps per file. Now copy a file with Norton Navigator.

5. Try a word search for "profits" or any other text string within files. It's at least ten times faster on average with Norton Navigator. No matter how many files you have. Or how big they are. In fact, the bigger the files, the more time you'll save.

6. Save another minute every time you delete, move, zip, or encrypt from any application's Open or Save dialog box. (Are you keeping count?)

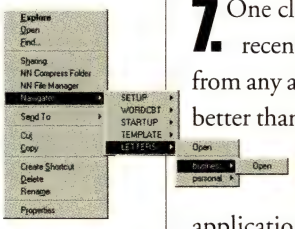
9. With Norton Navigator, you can create a different desktop for each project. So you can find your work more easily. And save even more time.

10. Windows 95 supports long file names for all of your new 32-bit applications. Norton Navigator supports long file names for most 16-bit applications, too. So you'll never again have to remember what "billgbox" means.

THE TOP 10 REASONS WHY NORTON NAVIGATOR USERS WORK FASTER IN WINDOWS 95.

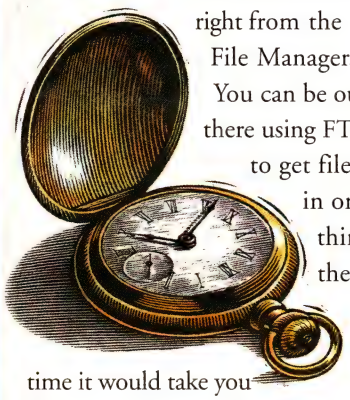
Mission accomplished. One step.

2. Opening a folder in Windows 95 takes a full five clicks of your trusty mouse. But with Norton Navigator, you can open any folder with just one simple click.



3. Compress a file. Our built-in PK-Zip compatible compression saves you a minute every time.

4. Use Norton Navigator to plug into your Internet connection right from the File Manager. You can be out there using FTP to get files in one third the time it would take you with a separate application.



7. One click is all it takes to access recently opened files or folders from any application. Now isn't that better than wading through folders?

8. Launch your favorite files, folders, or applications simply by pushing a button on the Norton Taskbar. No more going up and down to and from the Start menu over and over again.

NORTON NAVIGATOR FOR WINDOWS 95

NORTON NAVIGATOR ACCELERATES YOUR FILE MANAGEMENT IN WINDOWS 95.

Norton Navigator puts file management at your fingertips with Norton File Manager, Explorer Extension and FileAssist.

Norton Folder Navigator lets you open, copy, move or create a shortcut for any folder with just one mouse click.

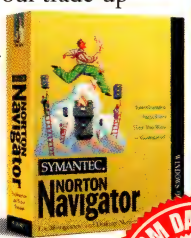
Norton Taskbar features multiple desktops that let you organize your files and find your work faster.

Norton FastFind performs specific text string searches at least ten times faster than Windows 95.

MAKE WINDOWS 95 AN EVEN BETTER PLACE TO BE.

Well, there you have it. Our Top Ten. But try Norton Navigator for yourself and we're sure you'll find your own favorites. Because one of the greatest things about Norton Navigator is it lets you work the way you want to work. Needless to say, it comes with our standard 60-day money-back guarantee. So get your trade-up edition today.

If you own Norton Desktop, PC Tools, XTree, or Norton Commander, get your $39.95 trade-up edition of Norton Navigator for Windows 95 today. To purchase, visit your software store or call us at 1-800-450-9760 ext. 9AP12.*



FROM DAY ONE, NORTON FOR WINDOWS 95

SYMANTEC.

*Trade-up editions will run only when specified Symantec and Central Point products are already installed. Check with your software store for qualifying versions. Price does not include shipping & handling or any applicable sales tax. Symantec is a registered trademark and Norton Navigator is a trademark of Symantec Corporation. All other brand names or trademarks are the property of their respective owners. ©1995 Symantec Corporation. All rights reserved. Visit us on the Internet at http://www.symantec.com. In Canada, call 1-800-365-8641. In Australia, call 2-879-6577. In Europe, call 31-71-353111.

Circle 112 on Inquiry Card.

INTRODUCING IT'S MORE MACHINE

intel inside
pentium PROCESSOR

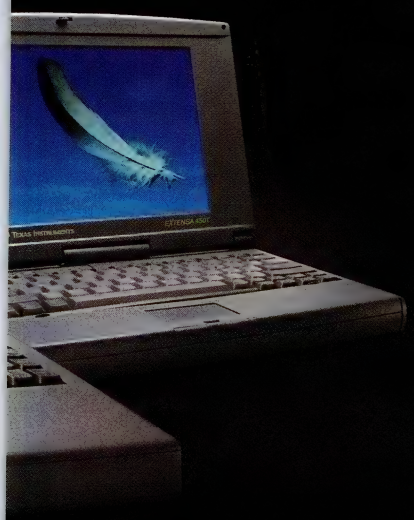
Extensa 550CD comes with integrated CD-ROM and 16-bit stereo sound for full multimedia capability.

Extensa 550's PCI Bus architecture enables optimal Pentium performance.

PCI BUS

Extensa and "Start Doing Extraordinary Things" are trademarks of Texas Instruments. Pentium and the Intel Inside logo are registered trademarks of Intel Corp. © 1995 TI.

TI EXTENSA. FOR THE MONEY.



EXTENSA

EXTENSA 450

- Weight: 5.0 lbs.
- DX4/75 processor
- 10.4" Dual Scan or 9.4" Active Matrix (TFT) display
- 4MB RAM, upgradeable to 32MB
- Serial infrared port

EXTENSA 550

- Pentium 75MHz
- 10.4" Dual Scan display
- 8MB RAM, upgradeable to 40MB
- Serial infrared port

EXTENSA 550CD

- Pentium 75MHz
- Integrated CD-ROM and 16-bit sound
- 10.4" Active Matrix (TFT) or 10.4" Dual Scan display
- 8MB RAM, upgradeable to 40MB
- Serial infrared port

Extensa 450 is just 5.0 lbs. – subnotebook weight.

Today, the pressure is on you to do something extraordinary. To squeeze out more productivity than ever before from the same 24 hour day.

That's why we made Extensa™ the new line of affordable portable computers.

The new TI Extensa 450 is the most extraordinary combination of light weight, power, and affordability.

The new TI Extensa 550 gives you the power of a Pentium® processor for the price of a 486.

START DOING EXTRAORDINARY THINGS™

And the new TI Extensa 550CD multimedia portable computer gives you CD-ROM and plenty of Pentium technology to enjoy it. In fact, at its price the only thing this powerhouse doesn't have is competition.

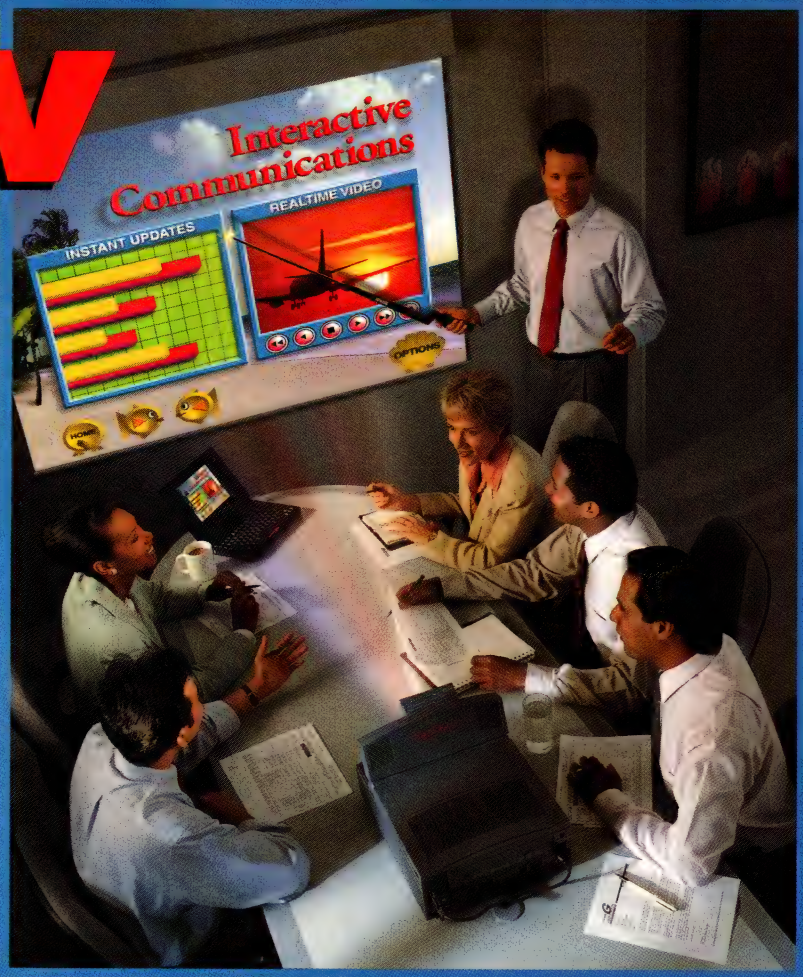
So now you can start working faster, start working better, start expanding your capabilities, start extending the power of a Pentium processor, start using multimedia and, most important of all, start making your money work harder.

In short, you can start doing extraordinary things. And it all starts with a phone call. **1-800-TI-TEXAS**. E-mail: 2ti@msg.ti.com. Internet: (www.ti.com).

TEXAS INSTRUMENTS

Circle 103 on Inquiry Card (RESELLERS: 104).

HOW TO KEEP YOUR AUDI-ENCE



WIRED

PLUG INTO PROXIMA®

Want a better way to connect with your audience? Discover the power of Proxima.

With a Proxima Desktop Projector,™ you can make a bigger impact with your presentations. Communicate your ideas more clearly. And be more productive. Without the limitations of slides and transparencies.

The Proxima DP5100 and the best-selling DP2810 lead the way in brightness, image quality, and price/performance.

Just plug a Proxima Desktop Projector into your PC or Mac, and you'll be able to project images from your computer screen onto a large screen or wall. It's that simple.

Want to add audio and video to your presentations? Make last-minute changes on the fly? No problem. Proxima gives you the flexibility and performance to take your multimedia presentations to a higher level.

FIND OUT MORE about Proxima today. And keep your audience wired.

FREE

"Get Wired With Proxima" Kit!
Get the facts on the latest Proxima products. Call for your free "Get Wired With Proxima" Kit today!

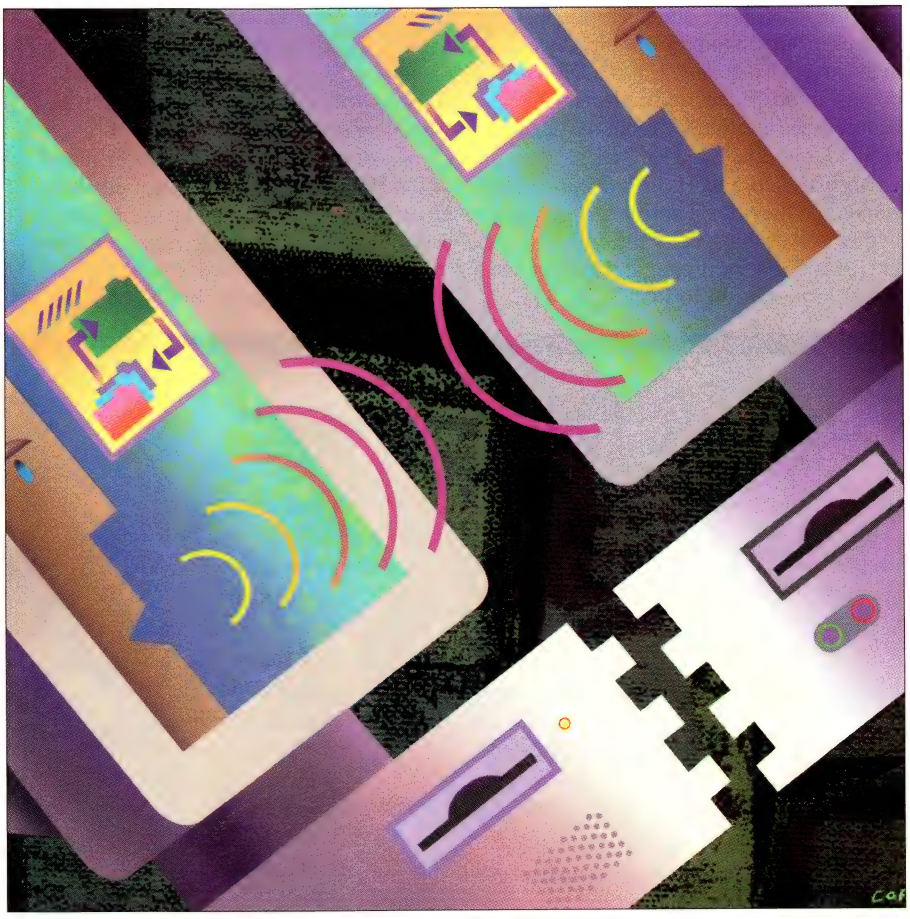
1-800-655-5155 ext. 102

PROXIMA®
THE DESKTOP PROJECTION COMPANY

Main Office: 9440 Carroll Park Drive, San Diego, CA 92121-2298, (619) 457-5500. FAX (619) 457-9647. European Office: Horsterweg 24, 6191 RX Beek, The Netherlands, +31-43-3650 243, FAX +31-43-3649 220.
Proxima and Cyclops are registered trademarks of Proxima Corporation. Desktop Projector and Desktop Projection are trademarks of Proxima Corporation. Other trademarks are the property of their respective owners.
U.S. and foreign patents are pending. Copyright 1995 Proxima Corporation. All rights reserved. Specifications subject to change without notice.

Face to Face

ANDREW W. DAVIS



KEN COFFELT © 1995

Videoconferencing systems from different vendors can now talk to each other, thanks to a standard called H.32x

At the 1964 New York World's Fair, AT&T showed the videophone, which delivered voice and video over standard telephone lines. Thirty years later, the newest videoconferencing products from AT&T Microelectronics still use standard telephone lines. But there's a difference.

Videoconferencing has finally shed its proprietary shackles. In 1964, AT&T was the last company to lose sleep over interoperability concerns: The original videophone had to communicate only with other AT&T products. But today, deregulation is the rule and interoperability is a serious issue. AT&T's latest-generation conferencing system can communicate with systems from other vendors. The AT&T system and competitors from Intel and PictureTel are an outgrowth of the sometimes acrimonious interoperability battles of the past two years.

But the battles are ending and the standards war is nearly won: By the end of the year, the International Telecommunications Union's H.324 standard should be formalized. H.324 defines how videoconferencing should work over plain old telephone service (POTS) lines and complements H.320, which does the same for ISDN. These standards could bring videoconferencing to general business applications.

Person to Person

Today's desktop videoconferencing (DVC) systems link the computers of collaborating workers (see the text boxes "In Your Face" on page 70 and "Face Off" on page 72). This is a fundamental difference from group videoconferencing, where participants gather in rooms that are connected to other videoconferencing centers. DVC systems keep collaborators in touch with important data that's accessible from their desktop systems.

According to a 1994 survey by Forward Concepts, a market researcher based in Tempe, Arizona, DVC most commonly connects workers within the same company. To date, most collaborative users have been in aircraft, automotive, and other industries with intensive engineering efforts that require visual communication among numerous workgroups. Intercompany videoconferencing requires standards to solve interoperability and networking issues.

Visions of ubiquitous videoconferencing existed even before the videophone turned heads at the World's Fair. The breakup of the standards logjam in recent months is cause for optimism over the technology's commercial potential. The ITU ratified H.320 in 1990 to cover switched digital networks. H.320 covers a wide range of network bandwidths. Audio signals can range from 16 to 64 Kbps. The video specification spans from one 64-Kbps ISDN link to 30 inverse-multiplexed 64-Kbps ISDN links.

But many vendors resisted H.320 and claimed their own algorithms offered better video quality. H.320 gained widespread acceptance last spring once the Intel-led Personal Conferencing Working Group backed off from its competing proposal based on

Intel's Indeo compression family.

However, H.320 is tied to ISDN, which is excellent technology for sending video but remains mired in rollout problems (see "Implementing ISDN," April BYTE). Attention now is moving to the other networks that connect PCs and workstations. H.324 is significant because it will eventually use a newer compression algorithm than that of H.320 and because it leverages the latest price and performance advances in silicon to promise high levels of audio and video quality. Like H.320, H.324 covers audio, video, and call-control procedures (see the figure "What's Under the H.32x Umbrella" on page 71).

. Both H.320 and H.324 are umbrella standards; they don't define technologies in themselves but specify the collection of ITU standards for digital and analog networks. In addition to POTS, the ITU is developing new recommendations for guaranteed-bandwidth packet-switched networks, such as IsoEthernet, and nonguaranteed packet-switched networks, such as ordinary Ethernet.

The Big Squeeze

The essential element in both standards is the H.261 video codec specification, a video-compression algorithm designed specifically for videoconferencing. Like MPEG, H.261 compresses images using discrete cosine transform (DCT). H.261 allows systems to fully encode certain key frames and encode only the differences among other frames. The main elements of the H.261 source coder are prediction, block transformation (spatial to frequency domain translation), quantization, and entropy coding. Here's how it works.

H.261 divides images into 8- by 8-pixel blocks and into macroblocks consisting of four luminance blocks and two corresponding chrominance blocks. The H.261 encoder starts by compressing and quantizing data to form *intramode* blocks; an intramode macroblock must be transmitted at least once every 132 frames in a process known as *forced updating*. The encoder also decodes results and subtracts the resulting image block (which is what the receiver sees) from the input video. If the differences are small, the block is not transmitted.

If there has been sufficient change, the encoder transforms, quantizes, entropy-encodes, and transmits the differences. The definition of "sufficient change" can vary from block to block. Change typically results from motion, but transmission noise can cause the video system to falsely infer change. As a result, commercial

In Your Face

Desktop videoconferencing (DVC) products are available for Windows, Macintosh, and Unix machines for circuit-switched digital WANs (ISDN), circuit-switched analog WANs (POTS), and packet-switched LANs.

H.320-compliant videoconferencing kits typically include a camera, a microphone/telephone handset, a codec, an ISDN interface board, and data-conferencing software. They range in price from $1500 to $2000. The lower-priced kits may use software for decompression or for both compression and decompression. Because software solutions rely on the host computer's processor, the faster the CPU, the better the performance users will see.

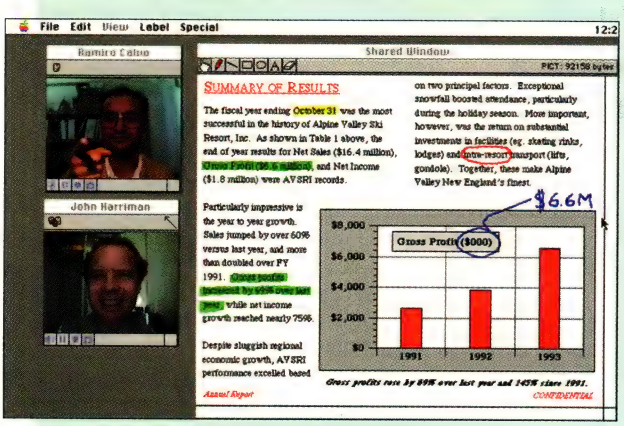
ISDN service providers may offer kits for less than $1000 as part of a service-contract bundle. You can also purchase DVC systems in the form of high-end computers with videoconferencing hardware and software already installed. This tends to be the most expensive alternative, with prices hitting $6000.

PictureTel's Live PCS 100 kit supports ISDN and includes a camera, a full-duplex speakerphone, and software.

ISDN Choices

AT&T, Intel, and PictureTel offer complete H.320 kits for ISDN-based conferencing under Windows. AT&T's Vistium 1300 system includes a dedicated processor for compression/decompression; the less pricey Vistium 1200 relies on the host processor for decompression. Both are available as board kits or prepackaged with AT&T desktop systems.

Intel's Proshare, which recently added H.320 support, uses the host CPU for decompression. PictureTel Live PCS 100 features a high-quality audio connection and full-duplex speakerphone.



Apple's QuickTime Videoconferencing and competing products from Sagem USA bring H.320 support to the Mac.

Vivo Software, which announced the first software-only H.320 codec, offers TeleWork-5, a less expensive superset of the original Windows product. The package now includes workgroup software, Internet access, remote LAN access, and fax modem emulation.

Many OEMs use Zydacron H.320 boards, which support 128- to 384-Kbps communications. Zydacron offers a low-level videoconferencing application as well as hooks for other, more comprehensive collaborative software packages.

Macintosh users can find H.320-compliant solutions from Apple, which supports the standard within the QuickTime extensions to the Macintosh OS. Sagem USA sells a NuBus H.320 codec board and separate ISDN board.

Gone to POTS

The upcoming H.324 standard and the new chips that perform the H.263/G.723 codec functions promise to combine improved quality with the convenience of POTS. Today, Creative Labs has both PC

H.261 products can offer video-signal noise filters to differentiate themselves from the competition, although these filters are outside the scope of the standard.

Macroblocks carry a flag to indicate whether they are predicted or intraframe macroblocks and a second flag to indicate whether the data should be transmitted or not. The criteria for choice of mode and for transmitting a block are not detailed by the recommendation and may be varied dynamically as part of the control strategy.

The standard requires H.261 devices to encode only the difference between a frame and the previous frame. Vendors can provide higher video quality and faster transmissions with optional motion-compensation and loop-filtering capabilities. Motion compensation analyzes macroblocks to identify a group in the previous frame that best matches a group in the current frame. The system then codes the difference along with a vector that describes the offset.

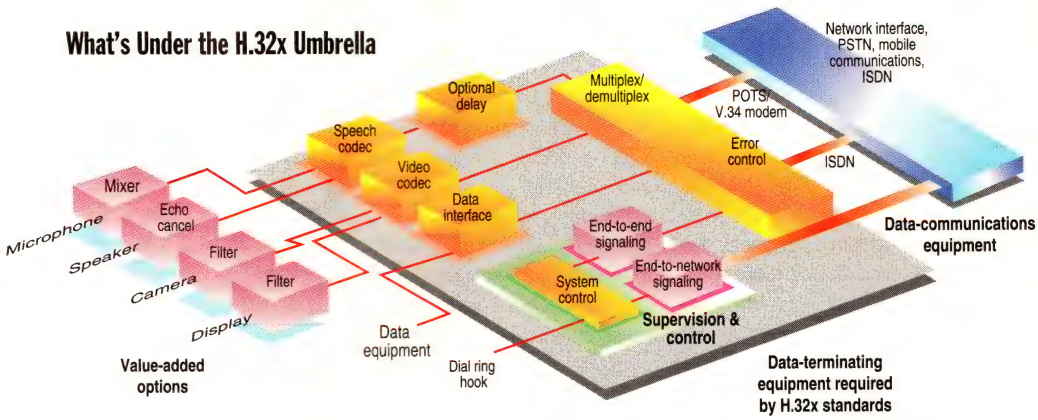
Unlike JPEG and MPEG, which are resolution- and image-size independent, H.261 specifies two image sizes. Common interchange format (CIF) is 352 pixels by 288 pixels. Quarter CIF (QCIF) is 176 pixels by 144 pixels. Like MPEG, H.261 uses prediction and motion estimation to reduce temporal redundancy, but it takes a different approach. MPEG maintains picture quality with maximum compression; H.261 minimizes encoding and decoding delay while achieving a fixed data rate.

What does this mean to videoconferencing users? H.261 makes a trade-off between frame rate and picture quality. As the motion content of the images increases, the codec has to do more computations and usually has to give up on image quality to maintain frame rate (or vice versa).

For an H.261 subsystem to meet the peak range of the standard—30 frames per second with full-motion estimation and loop filtering—it must execute approximately 8 billion operations per second. Most of this is for the optional motion estimation. However, designers can reduce operations at the expense of picture quality. For example, by applying a motion-estimation algorithm, codec designers can bring the system requirements down to about 1.5 billion operations per second (and thus let users do their videoconferencing on less-expensive hardware). Designers could also limit the video to 15 fps, which is a limit that ISDN bandwidths may impose.

Dedicated H.261 processors have reduced the complexity, development cycle, and costs of videoconferencing systems while providing better quality. The newer devices, such as AT&T's AVP III, support not only H.261 but an enhanced version (called H.263) and MPEG on the same chip.

What's Under the H.32x Umbrella



The H.320 and H.324 recommendations for videoconferencing terminals (center area) specify the means for audio and video coding, call control, and interfacing to data equipment. The standards include base-level requirements as well as optional specifications. Value-added opportunities (on the left) such as sound mixing, noise filtering, and video smoothing may be implemented by vendors to improve quality, but they are outside the ITU recommendations.

Motion Slickness

H.263, which is backward-compatible with H.261, offers improved picture quality by using a half-pixel new-motion estimation scheme rather than H.261's integer-estimation approach. The half-pixel technique is noticeably better at predicting changes to low-resolution images than H.261's motion-estimation technique is. Also, the Huffman coding table used in H.263 is optimized for low-bit-rate transmissions and provides superior imagery at 28.8 Kbps, the speed of high-end modems. The ITU is considering incorporating H.263 support into the H.320 standard.

H.263 allows (but does not require) implementation of predictive frames as well as the I (DCT-coded) frames in the codec. This is similar to MPEG's approach. While predictive frames stress the computational load and increase the frame delay, they also add quality to the video stream by raising the frame rate. These hooks give the standards room to grow. Developers can maintain compatibility and interoperability, while the quality of audio and video can improve with improvements in silicon price and gains in performance.

The rise of videoconferencing standards means vendors must find ways of differ-

and Macintosh solutions for POTS connections, and the two are interoperable. VCC offers a proprietary Windows-based POTS product using one to four V.34 modems for high bandwidth. Intelligence at Large sells a Mac solution that works across both WANs (POTS and ISDN) and TCP/IP LANs. Complete kits cost approximately $2000; the standalone software costs $100 to $300.

LAN versions of Proshare, PictureTel's LiveLan, and competitors from Invision, Viewpoint, and Insoft, use proprietary audio- and video-coding algorithms. But LAN conferencing standards do not yet exist, and H.320 does not work in a packet-switched network. Cornell University's CU-SeeMe software for Windows and Macs works over TCP/IP networks, including the Internet. Sun, HP, and Silicon Graphics also provide LAN conferencing equipment.

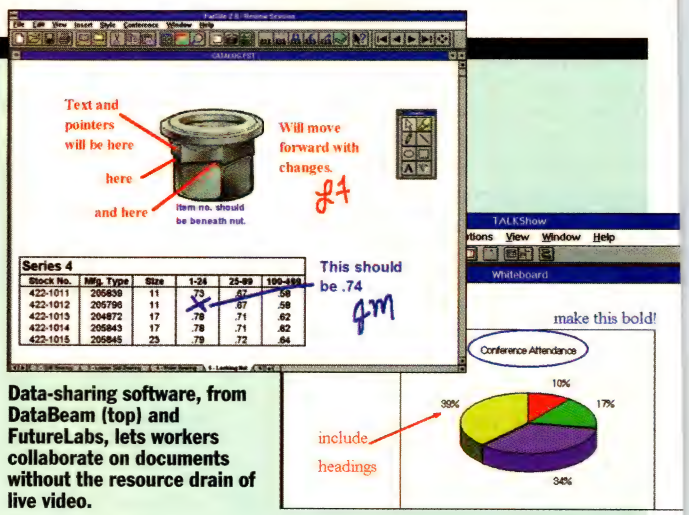
C-Phone from Target Technologies and Minx from Datapoint move analog video over a dedicated network and often use vacant wires inside standard Ethernet cables. For WAN connections, a shared server provides the required H.320 codec functions. Uncompressed analog video offers superior quality and does not stifle LAN data traffic. However, the scheme is not compatible with Ethernet or Token Ring bridges, routers, or switches. These products cost $2000 to $2500 per desktop, not including the required dedicated server, switch, and hub.

FACE OFF

Desktop videoconferencing (DVC) users often refer to the 90/10 rule to describe DVC's value: Data sharing accounts for 90 percent of the information content, while talking-head video accounts for the remainder. But video drains about 90 percent of the price and bandwidth resources for DVC systems. Also, without video, data conferencing is POTS-friendly, another point in favor of cost consciousness.

Early collaborative software provided a static whiteboard visible to all conference participants. Data from documents and spreadsheets appeared on the whiteboard, and changes made during a session had to be reentered in the original application. Newer versions give collaborators a shared program window, and users can make changes within the program window via keyboard or mouse commands, even if only one system has the application installed.

Stand-alone data-sharing products today range in price from $50 to $200, depending on their feature set and support for multiple LANs and WANs. Titles include Farsite, from DataBeam, which is bundled with many voice-and-data modems, and TalkShow and Vis-a-Vis from FutureLabs. These compete against data-conferencing versions of full-blown videoconferencing applications.



Data-sharing software, from DataBeam (top) and FutureLabs, lets workers collaborate on documents without the resource drain of live video.

Proprietary R.I.P.

The collaborative computing market is in the throes of two transitions. Customers are demanding solutions that comply with standards. The T.120 standards, first promulgated by the International Multimedia Teleconferencing Consortium and now submitted to the ITU, have been endorsed by virtually all conferencing vendors. This essentially ends the future for proprietary products.

DataBeam, which markets stand-alone software, is licensing T.120 technology to its erstwhile competitors and has signed up AT&T, British Telecom, Microsoft, PictureTel, and VTel. IBM's Lakes architecture, middleware that allows multiple types of data streams to be serialized and synchronized across multiple hardware and software platforms, will also be compliant with T.120.

Equally important is the shift from data conferencing as a stand-alone application to an embedded OS technology. Future OSes will have an abstraction layer for real-time, multipoint, multimedia communications. Note Microsoft and PictureTel's plan to develop voice- and data-conferencing APIs for independent software vendors. The APIs will provide access to multipoint data communications capabilities based on T.120.

OS/2 already includes Person-to-Person software. The Mac OS uses the QuickTime Conferencing extension, a foundation used by Apple's Media Conference Application and by Crosswise's Face-to-Face software, a cross-platform document-conferencing solution.

entiating themselves without offering proprietary technologies. Opportunities to add value come not from designing proprietary codecs but from applying pre-filters and post-filters to the video stream to make the codec more efficient and raise the quality of the decoded picture. Vendors can also add echo cancellation and sound mixing to the audio streams, or they can create API-smart software.

Now that vendors don't have to fight interoperability battles, they can concentrate on price and performance. We're already seeing positive signs. Prices of H.320-compliant videoconferencing kits have fallen from $6000 to less than $2000 in the past two years, while audio and video quality have improved noticeably. These kits benefit from a new generation of low-cost codec chips with higher processing power and support for multiple audio- and video-compression algorithms. Some computer makers now sell systems that come with conferencing hardware, so users can buy configured systems and avoid installation hassles.

Visual Support

Standards and new chips may help DVC evolve into an essential tool for business. Some vendors envision videoconferencing as an embedded technology. Already, one manufacturer of printing presses is showing a videoconferencing component that links printshop workers with technical staff, so they can get help if the press goes down. When talking heads venture from the Future Pavilion of the World's Fair to the nuts-and-bolts world of a shop floor, videoconferencing will be ubiquitous. ■

ACKNOWLEDGEMENT

Richard Schaphorst, president of Delta Information Systems (Horaham, PA) and an ITU official for Very Low Bitrate Visual Telephony, provided technical assistance for this article.

Andrew W. Davis is president of the Wainhouse Consulting Group (Southborough, MA), which provides research, planning, and marketing services. He can be reached at andrewwd@wainhouse.ultranet.com.

Where to Find

Apple Computer
Cupertino, CA
(408) 996-1010

AT&T Global Information Systems
Dayton, OH
(513) 445-5000

AT&T Microelectronics
Allentown, PA
(610) 712-6011
fax: (610) 712-5514

Creative Labs
Milpitas, CA
(408) 428-6600
fax: (408) 428-6611

Crosswise
Santa Cruz, CA
(408) 459-9060
fax: (408) 426-3859

DataBeam
Lexington, KY
(606) 245-3500
fax: (606) 245-3528

Datapoint
San Antonio, TX
(210) 593-7866
fax: (210) 593-7518

FutureLabs
Los Altos, CA
(415) 254-9000
fax: (415) 254-9010

IBM
Armonk, NY
(800) 426-4968
fax: (800) 426-4329

InSoft
Mechanicsburg, PA
(717) 730-9501
fax: (717) 730-9504

Intel
Hillsboro, OR
(503) 264-7354
fax: (503) 264-6835

Intelligence at Large
Philadelphia, PA
(215) 387-6002
fax: (215) 387-9215

InVision Systems
Tulsa, OK
(918) 584-7772
fax: (918) 584-7775

PictureTel
Danvers, MA
(508) 762-5000
fax: (508) 762-5245

Sagem USA
Cupertino, CA
(408) 446-8690

Target Technologies
Wilmington, NC
(910) 395-6100
fax: (910) 395-6108

VCC
Aliso Viejo, CA
(714) 452-0800
fax: (714) 581-9271

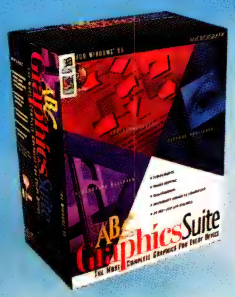
Viewpoint Systems
Dallas, TX
(214) 488-7100
fax: (214) 243-0635

Vivo Software
Waltham, MA
(617) 899-8900
fax: (617) 899-1400

Zydacron
Manchester, NH
(603) 647-1000
fax: (603) 647-9470

ABC GRAPHICS SUITE™ OPENS WINDOWS® 95 TO THE GRAPHICS WORLD.

(Enjoy the view.)



Designed for Windows 95

It will arm you with market-proven, award-winning applications for diagramming, drawing, painting, image editing and management of vast visual media libraries. You'll get the new "6.0" versions of ABC FlowCharter®, Picture Publisher®, Micrografx Designer™, and the revolutionary ABC Media Manager™ for use with any Windows 95 application. And with drag and drop automation and a Microsoft® Office Compatible™ interface, it's as intuitive as it is powerful. All for an introductory price of just $149.95*. ABC Graphics Suite. It will change the view from your Windows® for good.

PREVIEW CD

To get the whole picture, to order ABC Graphics Suite, or for a $9.95** Preview CD, call 1-800-376-5119.

Microsoft® OFFICE Compatible

MICROGRAFX®

*Upgrade price for owners of Micrografx or competitive graphics software and/or Microsoft Office 95. E.R.P for first-time buyers is $299.95.**The $9.95 charge for shipping and handling is non-refundable. Offer expires 12/31/95, applies to the U.S. and Canada only. The preview CD ROM is time-limited to 12/31/95. Copyright ©1995 Micrografx, Inc. All rights reserved. All product names are trademarks of their respective companies.

Circle 80 on Inquiry Card (RESELLERS: 81).

Now there's an authoritative of information

Data Communications
OpenView ADVISOR
The Independent Newsletter for Openview Users and Developers

FEBRUARY 1995
VOLUME 1, NO.1

IN THIS ISSUE

Cover Story / P.1
HP's Meta Schema: Blueprint for a Common Repository
by Jim Herman

Ask the Advisor / P.3
IP Address Cache Helps Avoid Reinstallation
by Rick Sturm

Expert Opinion / P.5
Netview's Loss is Openview's Gain
by Frank Henderson

World View / P. 6
Swedish Net Management Test Fest
by Johan Hjelm

Tech Tutorial / P. 4
RMON Alternative: Embedded Agents for Better Networks
by Rod Unverrich

Case Study / P. 6
Openview and 3M Company: Manufacturing a Network Management Architecture
by Jill Huntinton-Lee

Products / P.7

Developer's View / P. 2
Infrastructure Management Standards
by Michael Upp

McGraw Hill

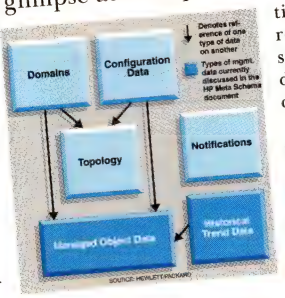
HP's Meta Schema: Blueprint for a Common Repository

By James Herman, vice president, Northeast Consulting Resources Inc.

COVER STORY

The term common repositor is sure e o most elusive in net management t day. Ev ent notion of what it mean should be designed. For exampl repository should contain everythi event ever received by the management positor as essentially containing con Hewlett-Packard's partial Meta Schema bluep in Openview gives a first glimpse at HP's proposal for solutio It also points to the vast amount of work left to be done before a working repository can become a reality.

To understand HP's initial attempt at defining an Openview common repository requires a closer look at the need it addresses. For the past several years, Openview has provided all the basic functions required of a management platform—management protocol support via SNMP, communications protocols, and application programming interfaces for developers. But the platform has lacked open services for the integration of management data from multiple applications. Under the covers, Openview applications don't share data. Instead, network inventory, event logs, trouble tickets, and other



other sources of management data reside in separate files and system locations, many times in different formats.

For customers, this lack of integration results in having to maintain several management data files, a task that can quickly become a juggling act when it comes to keeping data files in sync. If the same data item appears in multiple locations, it must be updated repeatedly. Multiple data sources make report writing difficult and limit the scope of customization.

Openview's lack of data integration also has drawbacks for developers, who must invest significant R&D dollars in getting their applications to work with those of other vendors—for example, to tie maintenance trouble tickets to specific devices in the network inventory.

Moving to a common repository would provide users with the database functions required to enter data into the system just once and have it reflected across multiple applications. Report writing could be easily customized.

(Continued on page 16)

PREMIERES FEBRUARY 1995

ndependent, objective source bout OpenView

Introducing the OpenView Advisor— from the editors of Data Communications

Corporate networkers who've made the move to OpenView know how tough it is to find the facts on the industry's leading net management framework. And the same goes for third-party developers looking to crack this lucrative market. Despite all its support, HP hardly qualifies as an impartial source, and surfing the Internet or searching computer magazines is no way to plan an effective enterprise management strategy.

The industry's only publication devoted exclusively to OpenView

OpenView Advisor gives users and developers exactly what they need: a monthly, vendor-independent newsletter that's got the technical savvy to solve their most pressing problems. Written and edited by the staff of DATA COMMUNICATIONS and some of the top consultants in the OpenView community, each issue is packed with in-depth analyses and hard-hitting technology reviews that can't be found anywhere else.

Take a look at the regular roster of features that make *OpenView Advisor* an indispensable tool for net managers and ISVs:

ANALYSIS
Industry experts detail and discuss OpenView trends and technical developments

TECHNICAL TUTORIALS
Step-by-step troubleshooting from users and developers who've overcome the OpenView challenges

CASE STUDIES
Detailed profiles of actual OpenView networks, with an emphasis on cost analysis, product selection, implementation strategies, and deployment issues

TECH TIPS
Concise, hands-on solutions to common OpenView problems from users, developers, and HP engineers

DEVELOPER'S VIEW
An open forum for application developers, system integrators, and third-party vendors

INTERVIEWS
No-holds barred discussions with key HP engineers and product managers for the OpenView line

INTERNATIONAL ISSUES
Addresses the concerns of global networkers, including managing across WAN links, finding products, and integrating standards and platforms

PRODUCTS
Exclusive coverage of new and upcoming products and services for the OpenView environment

Take advantage of this one-time introductory offer from OpenView Advisor

Act now and become a charter subscriber to *OpenView Advisor* for the special price of only $495 for 12 issues ($595 outside North America). That's a savings of $100 off the regular subscription price. But you have to move quickly—this offer is available for a limited time only.

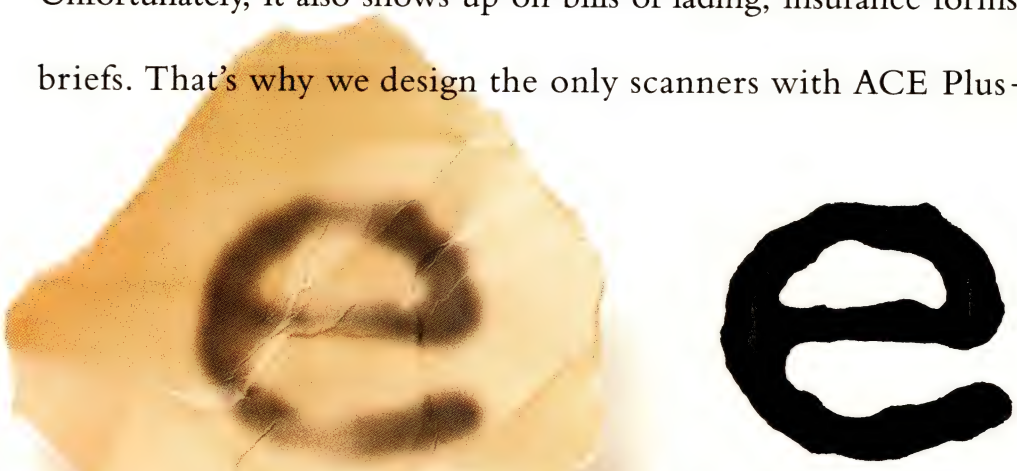
To order, call toll-free in the U.S.: 1-800-598-0474
To order outside the U.S. call: 615-377-3322
Fax orders to: 615-377-0525
Internet address: openview@mcgraw-hill.com

Data Communications

T50101

Cutting-edge technology has no room for warm, fuzzy characters.

Soft, fuzzy type is great on kid's pajamas and schmaltzy greeting cards. Unfortunately, it also shows up on bills of lading, insurance forms, and legal briefs. That's why we design the only scanners with ACE Plus–Adaptive



Contrast Enhancement. This option turns soft-edge, low-contrast characters into cold, hard letterforms. And that can actually make scanned documents more readable than the originals. It also makes sure operators don't spend all day scanning documents over and over. We have a brochure that tells you the whole story. For a copy, call 1-708-675-7600, or e-mail us: copiscan@mcs.com.

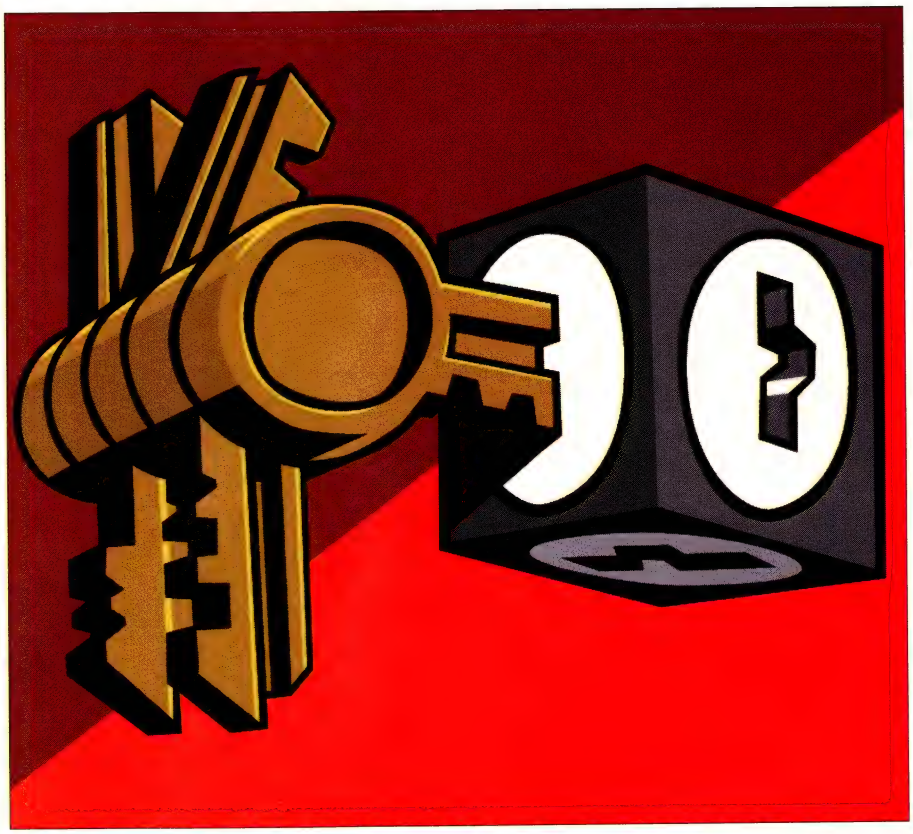
BELL+HOWELL

The Document Management People

Circle 64 on Inquiry Card (RESELLERS: 65).

Picking the Crypto Locks

PETER WAYNER



DOUG FRASER © 1995

How secure is your encrypted data? Advances in mathematics and increased computing power mean you need longer keys and stronger algorithms if you still want to keep your secrets. Both private-key encryption (which uses a single key for coding and decoding) and public-key systems (which use separate keys for encryption and decryption) are increasingly vulnerable to determined attack. But do these weaknesses represent a real threat to encrypted data, or are they still just intriguing research results?

Unfortunately, when we try to assess the effectiveness of today's popular cryptographic systems, we run into a problem of mathematical ignorance. Most people who are familiar with mathematics can work in two directions, forward and backward, like the simple algebraic equation a = b + 1. We can determine the value of the first variable from that of the second and vice versa. Crypto systems, however, generally rely on mathematics that works only in one direction. People assume these systems are secure because no one has yet shown how to work the mathematics backward and break open the message. In general, we determine the strength of most cryptographic systems by seeing how well they avoid the attacks we know have been used on other systems. If none of the past attacks seems to work, then we deem a system secure. For now.

A new technique called differential cryptanalysis can break even DES quickly

Let's look at how today's codebreakers work, the resources and time they need, and what we require in the way of new systems and longer keys. Recent assessments of the strength of private-key crypto systems involve looking for theoretical holes and measuring the time needed for a brute-force attack. Finding the holes can be devilishly hard, calling for deep mathematical insights. Brute-force attacks are easier to mount if enough computational hardware is available, but they're also easy to defend against.

The most important development in the realm of data encryption in recent years is Eli Biham and Adi Shamir's *differential cryptanalysis*. They showed how to mount a limited attack on today's most widely used cryptosystem, DES (the federal Data Encryption Standard), which is also the basis for Unix's password system.

Imagine that you had access to your victim's DES cipher "box" (the common term for an enciphering system) with preloaded keys. Your goal is to determine the 56-bit key, so that you can decrypt the other messages your victim had encrypted with the box. Biham and Shamir showed that you could infer the hidden key if you could pass 2^{47} messages through the box and observe what came out. This *chosen plaintext attack* builds up a statistical model of the cipher, and it needs this many plaintexts to produce an answer with confidence.

Most intriguing, this work exposed flaws in many DES substitutes. Because the U.S. government classified the details behind DES's design, many assumed that there might be a trapdoor through which the government could eavesdrop. To circumvent these potential trapdoors, some folks designed their own variations of DES. Most of these new ciphers, however, fall even faster to Biham and Shamir's mathematical machinery. FEAL-4, a faster replacement, for example, takes only four well-chosen plaintexts.

continued on page 80

Factoring in Public-Key's Future

Long thought nearly unbreakable, public-key cryptography is yielding to attack. The secret of security here is key length.

BY BRUCE SCHNEIER

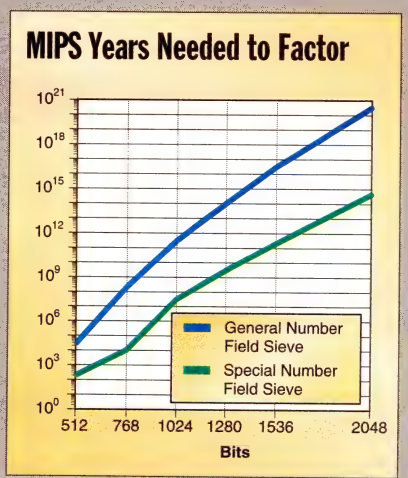
Factoring large numbers is hard but not as hard as it used to be. This has grave implications for the effectiveness of public-key cryptography, which relies on the difficulty of factoring long keys for its security. But how long is long enough?

In 1976, Richard Guy wrote: "I shall be surprised if anyone regularly factors numbers of size 10^{80} without special form during the present century." In 1977, Ron Rivest said that factoring a 125-digit number would take 40 quadrillion years. In 1994, a 129-digit number was factored. The lesson here is that making predictions is foolish.

Today, 512-bit keys are common. Factoring them, thus destroying their security, is well within the range of possibility for today's computing resources. A weekend-long worm on the Internet could do it.

Computing power is measured in MIPS-years: a million-instructions-per-second computer running for one year, or about 3×10^{13} instructions. A 100-MHz Pentium is about a 50-MIPS machine; a 1600-node Intel Paragon is about 50,000 MIPS.

In 1983, a Cray X-MP supercomputer



factored a 71-digit number in 0.1 MIPS-years, using 9.5 CPU hours. That's expensive. Factoring the 129-digit number in 1994 required 5000 MIPS-years and used the idle time on 1600 computers around the world over an eight-month period. Although it took longer, it was essentially free.

Those two computations used what's called the *quadratic sieve*, but a newer, more powerful algorithm has arrived. The *general number field sieve* is faster than the quadratic sieve for numbers well below 116 digits and can factor a 512-bit number over 10 times faster—it would take less than a year to run on an 1800-node Intel Paragon.

And the process gets still faster. Mathematicians keep coming up with new tricks, new optimizations, and new techniques. A related algorithm, the *special number field sieve*, can already factor numbers of a specialized form (not generally used for cryptography) much faster. So we can probably optimize the general number field sieve to run that fast. For all we know, the National Security Agency is already doing it.

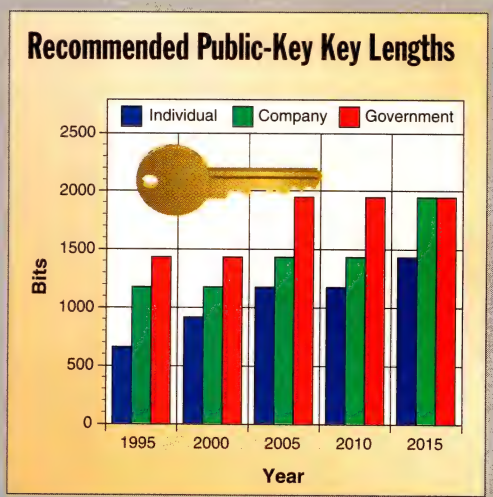
The figure "MIPS Years Needed to Factor" gives the number of MIPS-years required to factor "special" and "general" numbers of different lengths.

How Big Is Big Enough?

The wise cryptographer is ultraconservative when choosing key lengths for a public-key system. You must consider the intended security, the key's expected lifetime, and the current state of the factoring art. Now you need a 1024-bit number to get the same security you got from a 512-bit number in the early 1980s. If you want your keys to remain secure for 20 years, 1024 bits is probably too short.

Consider these assumptions from the mathematicians who factored RSA-129: We believe we could acquire 100,000 machines without superhuman or unethical efforts and without an Internet worm or virus. Many organizations have several thousand machines on the Net. Using their facilities would require diplomacy but should not be impossible. Assuming an average power of 5 MIPS and one year elapsed time, we could reasonably embark on a project that would require half a million MIPS-years. The project to factor the 129-digit number harnessed an estimated 0.03 percent of the Internet's total computing power. A well-publicized project might be able to harness 2 percent of the world's computing power for a year.

My recommendations for public-key lengths are given in the figure "Recommended Public-Key Key Lengths" according to how long you require the key to be secure. There are three key lengths given for each period—one secure against



an individual cryptanalyst who can get his hands on 10,000 MIPS-years, one against a major corporation that could harness 10^7 MIPS-years, and the third secure against a major government and 10^9 MIPS-years. These figures assume that computing power will increase by a factor of 10 every five years and that mathematical advances will let us factor numbers at the speeds of the special number field sieve.

Not everyone will agree with these final recommendations. The National Institute of Standards and Technology has mandated 512- to 1024-bit keys for its Digital Signature Standard. PGP has a maximum RSA key length of 1280 bits. Arjen Lenstra, the world's most successful factorer, refuses to predict beyond 10 years. There's always the possibility that an advance in factoring will surprise me as well, though I tried to factor everything into my calculations. But why trust me? I just proved my own foolishness by making predictions. ■

Bruce Schneier is the author of Applied Cryptography *(John Wiley), the second edition of which is due out in December. He can be reached on the Internet as schneier@winternet.com, or on BIX c/o editors@bix.com.*

Start

To Get a Clear Picture of What Windows® 95 Can Do,

Use One of These Monitors.

Maximize the power and promise of Windows 95 with a ViewSonic high-performance color monitor. Make an impact with these *Plug & Play+** ViewSonic monitors which automatically configure the graphics controller to produce optimal viewing characteristics, such as refresh rates and resolutions. Windows 95 has never looked better and installing a monitor has never been easier.

The ViewSonic family of monitors delivers brighter, sharper, more accurate images for the best display of all your Windows 95 applications. Available in 15" through 21" (13.7" to 19.7" diagonal viewable areas), these superior monitors offer superb color, high refresh rates and a wide array of features for increased performance, even for the most demanding user. Combined with eye-pleasing image quality, our multimedia models feature bezel integrated speakers which provide crisp, clear audio.

Plug & Play+ Monitors

	ViewSonic 15GS	ViewSonic 15GA	ViewSonic 17GA	ViewSonic 17GS	ViewSonic 17PS	ViewSonic 21PS
CRT Size	15"	15"	17"	17"	17"	21"
Viewable Area	13.7"	14.0"	16.0"	15.7"	15.7"	19.7"
Dot Pitch	0.28mm	0.27mm	0.27mm	0.27mm	0.25mm	0.25mm
Recommended Resolution	1,024 x 768 @ 85Hz	1,024 x 768 @ 85Hz	1,024 x 768 @ 85Hz	1,024 x 768 @ 85Hz	1,280 x 1,024 @ 77Hz	1,280 x 1,024 @ 77Hz
TCO Certified	Yes*	Yes	Yes	Yes	Yes	Yes**
Speakers	--	Bezel Integrated	Bezel Integrated	--	--	--

*Model 15GBS-2 only.
**Model 21PPS-2 only.

All monitors are EPA Energy Star™ and MPR-II certified.

Besides being compatible with Windows 95, it's no surprise ViewSonic monitors are compatible with your budget.

Call us at (800) 888-8583 Ext. #374 - we'll make everything perfectly clear.

Plug & Play+

ViewSonic®
See The Difference!™
and Hear

Designed for Microsoft® Windows® 95

Tel: (800) 888-8583 Ext. 374 or (909) 869-7976 • Fax: (909) 869-7958
Call FaxSonic at (909) 869-7318 (fax-on-demand) • Internet: http://www.viewsonic.com

* Requires a DDC compatible video card. All products and trademarks are brand names of their respective companies.
The three bird logo is a registered trademark of ViewSonic Corporation. Specifications subject to change without notice.

Circle 106 on Inquiry Card (RESELLERS: 107).

STRENGTHS AND WEAKNESSES OF CRYPTO ALGORITHMS

ALGORITHM	COMMENT	STRENGTHS	WEAKNESSES
DES	Standard, widely accepted	Long-tested	Has yielded to DC
FEAL-4	DES substitute		Easily broken by DC
GDES, NewDES	DES-like		Easily broken by DC
Khufu	DES-like	Secure against DC	New, unknown
Blowfish	DES-like	Secure against DC	New, unknown
RC-4	Proprietary	Variable-length key	Unknown
RSA Public Key	Widely used	Long-tested	Vulnerable to advances in factoring
Skipjack	Classified	Considered strong	Algorithm must remain secret to preserve law-enforcement trapdoor

DC = differential cryptanalysis

Recently, the IBM scientists who originally designed DES revealed that they anticipated Biham and Shamir's attack and optimized DES to resist it. Because other nongovernment cryptographers didn't know about this attack, they couldn't design their software to resist it. Now the information is public, and there are new ciphers that hold up well against these attacks. Ralph Merkle's Khufu and Bruce Schneier's Blowfish are two private-key ciphers that are similar to DES but resist differential cryptography. They do this by creating new S-boxes for each encryption, using the key to randomize them. (S-boxes are the essential scrambling elements of DES-like ciphers. Think of them as lookup tables or nonlinear functions; their outputs should be as random as possible.) Differential cryptanalysis works only if the attacker knows what's in the S-boxes.

This work also revealed some stunning counterintuitive results. Key length is usually taken as a rough measure of a system's security. DES uses 56-bit keys; a brute-force attacker might need to try all 2^{56} keys to find the right one. A longer key would mean a longer brute-force attack. However, Biham and Shamir showed that even if DES used longer keys, it would hardly be any stronger against differential cryptanalysis. The statistical model would still be solvable if DES used the maximum of 768 bits.

Applying this knowledge to other types of ciphers is tricky. RSA Data Security markets a proprietary algorithm called RC-4 that accepts a variable-length key; this algorithm is used in many products. The flexible key length can be an advantage in some situations. For example, the government allows general export of software using RC-4 with a 40-bit key, but similar software using a longer key must stay within the U.S. While we don't know if differential cryptanalysis can be applied to RC-4 directly, because of the algorithm's proprietary nature, the results with DES suggest that more key is not necessarily stronger.

Men and Machines

Mathematical tools like differential cryptanalysis can be the most powerful attack against a cipher system. Brute-force attacks are normally a last resort, rare in practice because cipher designers routinely use long key lengths specifically to preclude them. But times are changing. We're reaching a point at which a large machine can quickly search the entire keyspace of DES. DES is still in wide use; it's been the commercial and governmental standard for nearly two decades. Replacing such standards can be a painfully slow process.

DES users should be thinking about what can be done with off-the-shelf hardware.

Brute-force attacks simply use large machines that try all possible passwords in parallel. It's even possible to produce native chips that run DES. Michael Wiener of Bell Northern Research described how to build a $1 million machine using a pipelined DES processor that could cruise through all possible keys in about 7 hours.

Massively parallel machines can also attack the problem. Some of the most promising emerging machines distribute small, 1-bit processors directly onto the memory chips. Some have 1024 processors on a chip with 42 bits of memory per processor. (Before it entered Chapter 11, Cray Computer was building for the National Security Agency a special Cray 3 with such processor-embedded memory.) In 1992 I designed a machine using 1 million associative processor memory chips (standard DRAM densities) from Coherent Research (Syracuse, NY) that could attack all of DES in one day. This machine could be reprogrammed to attack other DES-like ciphers. Linden Technology (Austin, TX) is currently exploring manufacturing new 4-Mb DRAMs with the 1024 associative processors built onto the chip.

The effect of brute-force attacks on DES is also important for Unix security, which stores each password after passing it through DES 25 times. At log-in, you type your password; it's encrypted 25 times and the result compared against the password file. If it matches, the system grants you access. Because the password file doesn't contain the passwords themselves, unauthorized users can't use the file to recover them directly. They must use a brute-force machine. However, the brute-force attack can be relatively successful against Unix, because the keyspace is smaller. Most users limit their passwords to alphabetic characters, occasionally adding numbers. This makes searching for passwords much faster; it could be done quite quickly with an associative-memory parallel processor. One estimate suggests that a computer using 512 of Linden's chips could test all six-character alphanumeric passwords in 15 minutes. Clearly, the Unix password structure needs to be rethought in light of today's machines and code-breaking techniques.

Because of this new vulnerability, you may want to explore other, newer ciphers, such as Merkle's Khufu or Schneier's Blowfish. The classified Skipjack algorithm buried inside the U.S. government's Clipper and Capstone encryption chips also uses S-boxes, but little is known about their design. There's little reliable public information about RSA Data Security's RC-4. Anyone who uses these algorithms must be prepared to trust the wits of the designers, because the algorithms have not undergone the intensely thorough and long-time public scrutiny given to DES.

Many organizations have opted to continue with DES, but the current state of the art is triple-DES—three passes of the algorithm with either 112- or 168-bit keys. This effectively guards against both brute-force and differential analysis attacks. These users can rest assured that, paradoxically, all the attacks focused on DES continues to keep it strong. ■

Where to Find

RC-4
RSA Data Security, Inc.
Redwood City, CA 94065
(415) 595-8782
fax: (415) 595-1783
Circle 1060 on Inquiry Card.

Peter Wayner is a BYTE consulting editor living in Baltimore, MD. You can reach him on the Internet at pcw@access.digex.net, on BIX as pwayner@bix.com, or on the World Wide Web at http://access.digex.net/~pcw/pcwpage.html.

DATA MINING

Turn computers loose on your data, and you don't know *what* they'll come up with—that's the whole point

There's gold in your data, but you can't see it. It may be as simple (and wealth-producing) as the realization that baby-food buyers are probably also diaper purchasers. It may be as profound as a new law of nature. But no human who's looked at your data has seen this hidden gold. How can you find it?

Data mining lets the power of computers do the work of sifting through your vast data stores. Tireless and relentless searching can find the tiny nugget of gold in a mountain of data slag.

In "The Data Gold Rush," Sara Reese Hedberg shows the already wide variety of uses for the relatively young practice of data mining. From analyzing customer purchases to analyzing Supreme Court decisions, from discovering patterns in health care to discovering galaxies, data mining has an enormous breadth of applications. Large corporations are rushing to realize the potential payoffs of data mining, both in the data itself and in marketing their proprietary tools.

In "A Data Miner's Tools," Karen Watterson explains the three categories of software to perform data mining. Query-and-reporting tools, in vastly simplified and easier-to-use forms, require close human direction and data laid out in databases or other special formats. Multidimensional analysis (MDA) tools demand less human guidance but still need data in special forms. Intelligent agents are virtually autonomous, are capable of making their own observations and conclusions, and can handle data as free-form as paragraphs of text.

"Data Mining Dynamite" by Cheryl D. Krivda shows how to facilitate the data-mining process. Data is handled far faster after it has been cleansed of unnecessary fields and stored in more convenient forms. Housing data in data warehouses reduces the load on production mainframes and supports client/server analysis. Parallel computing speeds the search process with multiple simultaneous queries. And any activity handling this volume of data requires consideration of physical storage options.

In the short term, the results of data mining will be in profitable if mundane business-related consequences. Micro-marketing campaigns will explore new niches. Advertising will target potential customers with new precision.

In the not-too-long term, data mining may become as common and easy to use as E-mail. We may direct our tools to find the best airfare to the Grand Canyon, root out a phone number for a long-lost classmate, or find the best prices on lawn mowers. The software will figure out where to look, how to evaluate what it finds, and when to quit. Our knowledge helpers may become as indispensable as the telephone.

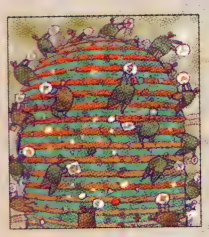
But it's the long-term prospects of data mining that are truly breathtaking. Imagine intelligent agents being turned loose on medical-research data or on subatomic-particle information. Computers may reveal new treatments for diseases or new insights into the nature of the universe. We may well see the day when the Nobel prize for a great discovery is awarded to a search algorithm. ■

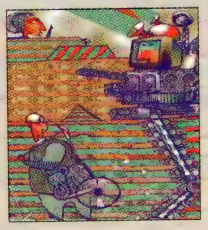
—Edmund X. DeJesus, Senior Editor

The Data Gold Rush
From molecular chemistry to mortgage credit checks, there are many uses for data mining.....83

A Data Miner's Tools
You can choose from query-and-reporting tools, multidimensional analysis tools, and intelligent agents....91

Data-Mining Dynamite
Massively parallel computers and RAID subsystems: What you should do to facilitate data mining 97





ILLUSTRATIONS: VICTOR GAD © 1995

BYTE's Pan-European Postcard Deck Targets Influential European Technology Experts

The BYTE EURO-DECK offers a unique direct mail approach to increasing sales in the $114 billion European computer market. Reach 50,000 BYTE subscribers for under 4¢ per reader!

Circulation of the BYTE EURO-DECK is targeted to computer experts in over 20 countries in Western Europe. Take full advantage of the benefits BYTE provides with this affordable, direct channel to Europe. For information on the next BYTE EURO-DECK, call Joseph Mabe at 603/924-2533 or fax to 603/924-2683.

BYTE EURO DECK

THE DATA GOLD RUSH

Smart data miners are cashing in on valuable information buried in private and public data sources

SARA REESE HEDBERG

VICTOR GAD © 1995

It's in there. The discovery, the fact, the one piece of the puzzle that will blow away the competition, propel your company to the top, and stick a "VP" after your name. It's right there, in your database. But you can't see it. Yet.

The amount of information stored in databases is exploding. From zillions of point-of-sale transactions and credit card purchases to pixel-by-pixel images of galaxies, databases are now measured in gigabytes and terabytes. In today's fiercely competitive business environment, companies need to rapidly turn those terabytes of raw data into significant insights to guide their marketing, investment, and management strategies.

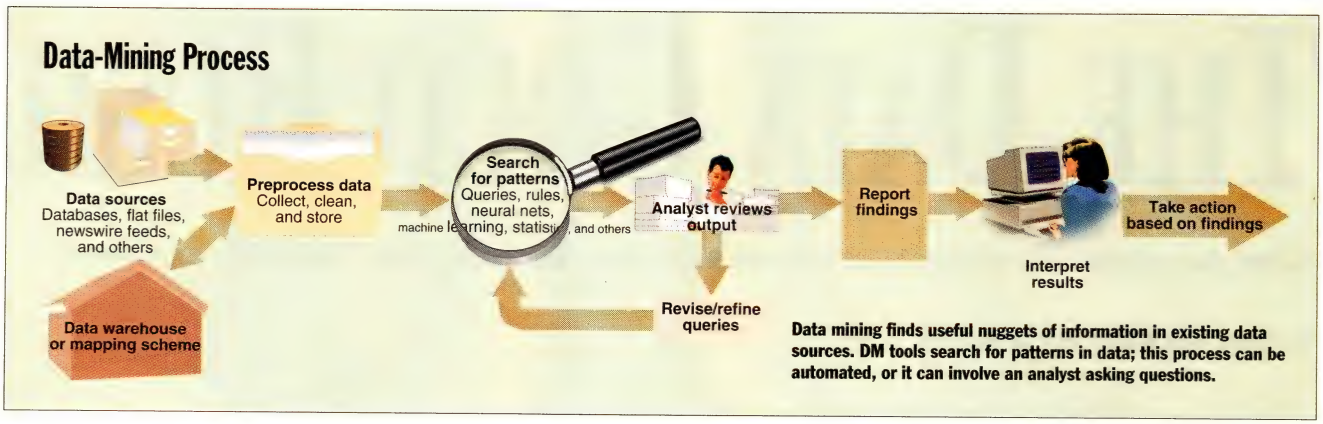
It would take many lifetimes for an analyst to pore over 2 million books—the equivalent of a terabyte—to glean important trends. But analysts have to. For instance, Wal-Mart, the chain of over 2000 retail stores, every day uploads 20 million point-of-sale transactions to an AT&T massively parallel system with 483 processors running a centralized database. At corporate headquarters, they want to know trends down to the last Q-Tip.

Luckily, computer techniques are now being developed to assist analysts in their work. Data mining (DM), or knowledge discovery, is the computer-assisted process of digging through and analyzing enormous sets of data and then extracting the *meaning* of the data nuggets. DM is being used both to describe past trends and to predict future trends.

Mining and Refining Data

Experts involved in significant DM efforts agree that the DM process must begin with the business problem. Since DM is really providing a platform or workbench for the analyst, understanding the job of the analyst logically comes first. Once the DM system developer understands the analyst's job, the next step is to understand those

The Data Gold Rush



data sources that the analyst uses and the experience and knowledge the analyst brings to the evaluation.

The DM process generally starts with collecting and cleaning information, then storing it, typically in some type of data warehouse or datamart (see the figure "Data-Mining Process"). But in some of the more advanced DM work, such as that at AT&T Bell Labs, advanced knowledge-representation tools can logically describe the contents of databases themselves, then use this mapping as a meta-layer to the data. Data sources are typically flat files of point-of-sale transactions and databases of all flavors. There are experiments underway in mining other data sources, such as IBM's project in Paris to analyze text straight off the newswires.

DM tools search for patterns in data. This search can be performed automatically by the system (a bottom-up dredging of raw facts to discover connections) or interactively with the analyst asking questions (a top-down search to test hypotheses). A range of computer tools—such as neural networks, rule-based systems, case-based reasoning, machine learning, and statistical programs—either alone or in combination can be applied to a problem.

Typically with DM, the search process is iterative, so that as analysts review the output, they form a new set of questions to refine the search or elaborate on some aspect of the findings. Once the iterative search process is complete, the data-mining system generates report findings. It is then the job of humans to interpret the results of the mining process and to take action based on those findings.

AT&T, A.C. Nielsen, and American Express are among the growing ranks of companies implementing DM techniques for sales and marketing. These systems are crunching through terabytes of point-of-sale data to aid analysts in understanding consumer behavior and promotional strategies. Why? To increase profitability, of course.

Similarly, financial analysts are plowing through vast sets of financial records, data feeds, and other information sources in order to make investment decisions. Healthcare organizations are examining medical records in order to understand trends of the past; they hope this information can help reduce their costs in the future. Major corporations such as General Motors, GTE, Lockheed, Microsoft, and IBM all have R&D groups working on proprietary advanced DM techniques and applications.

Siftware

Hardware and software vendors are extolling the DM capabilities of their prod-

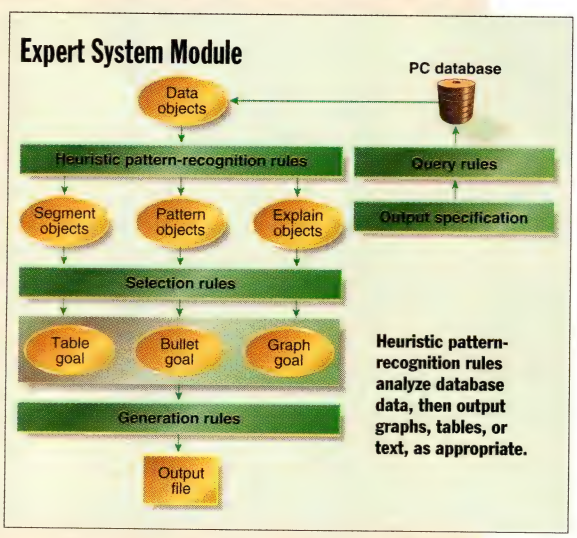
MARKETING

Many marketers believe one of the most powerful competitive weapons is understanding and targeting each customer's individual needs. To this end, more companies are harnessing DM techniques to shed light on customer preferences and buying patterns. With this information, companies can better target customers with products and promotional offerings.

A.C. Nielsen's Spotlight is a good example of a DM tool. Nielsen clients use Spotlight to mine point-of-sale databases. These terabyte-size databases contain facts (e.g., quantities sold, dates of sale, prices) about thousands of products, tracked across hundreds of geographic areas for at least 125 weeks. Spotlight transforms tasks that would take a human from weeks to months to do into tasks a computer can do in minutes to hours. Nielsen says it has sold about 100 copies of Spotlight (DOS and Windows) to U.S. clients, who have in turn deployed it to field-sales representatives in multiple regional centers. The software frees analysts to work on higher-level projects instead of being swamped by routine, laborious chores.

In the past two years, a global group at Nielsen has changed the U.S. version of Spotlight for use in other countries. "Spotlight is the most widely distributed application in the consumer packaged-goods industry," claims Mark Ahrens, director of custom software sales at Nielsen.

American Express is analyzing the shopping patterns of its card holders and using the information to offer targeted promotions.



STATISTICA

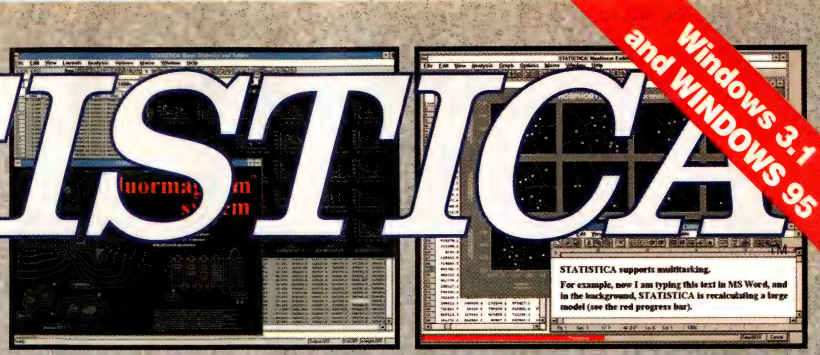
STATISTICA™ (automatically configures itself for Windows 3.1 or WINDOWS 95) ■ A complete data analysis system with thousands of on-screen customizable, presentation-quality graphs fully integrated with all procedures ■ Comprehensive *Windows*™ support, OLE (client and server), DDE, customizable *Auto Task* toolbars, pop-up menus ■ Multiple data-, results-, and graph-windows with *data-graph* links ■ The largest selection of statistics and graphs in a single system; comprehensive implementations of: Exploratory techniques with advanced brushing; multi-way tables with banners (presentation-quality reports); nonparametrics; distribution fitting; multiple regression; general nonlinear estimation; stepwise logit/probit; general ANCOVA/MANCOVA; stepwise discriminant analysis; log-linear analysis; confirmatory/ exploratory factor analysis; cluster analysis; multidimensional scaling; canonical correlation; item analysis/reliability; survival analysis; a large selection of time series modeling/forecasting techniques; structural equation modeling with *Monte Carlo* simulations; and much more ■ On-line *Electronic Manual* with comprehensive introductions to each procedure and examples ■ Hypertext-based Stats Advisor expert system ■ Workbooks with multiple *AutoOpen* documents (e.g., graphs, reports) ■ Extensive data management facilities (fast spreadsheet of unlimited capacity with long formulas, *Drag-and-Drop, AutoFill, Auto-Recalculate,* split-screen/variable-speed scrolling, advanced Clipboard support, DDE links, hot links to graphs, relational merge, data verification/cleaning) ■ Powerful *STATISTICA BASIC* language (professional development environment) with matrix operations, full graphics support, and interface to external programs (*DLLs*) ■ Batch command language and editable macros, flexible "turn-key" and automation options, custom-designed procedures can be added to floating *Auto Task* toolbars ■ All output displayed in Scrollsheets™ (dynamic, customizable, presentation-quality tables with instant 2D, 3D, and multiple graphs) or word processor-style report editor (of unlimited capacity) that combines text and graphs ■ Extremely large analysis designs (e.g., correlation matrices up to 32,000x32,000, unlimited ANOVA designs) ■ Megafile Manager with up to 32,000 variables (8 Mb) per record ■ Unlimited size of files; extended ("quadruple") precision; unmatched speed ■ Exchanges data and graphs with other applications via DDE, OLE, or an extensive selection of file import/export facilities (incl. *ODBC* access to virtually all data bases and mainframe files) ■ Hundreds of types of graphs, incl. categorized multiple 2D and 3D graphs, ternary 2D/3D graphs, matrix plots, icons, and unique multivariate (e.g., 4D) graphs ■ Facilities to custom-design new graph types and add them permanently to menus or toolbars ■ On-screen graph customization with advanced drawing tools (e.g., scrolling and editing of complex objects in 32x real zoom mode), compound (nested) OLE documents, *Multiple-Graph AutoLayout Wizard,* templates, special effects, icons, page layout control for slides and printouts; unmatched speed of graph redraw ■ Interactive rotation, perspective and cross-sections of 3D displays ■ Large selection of tools for graphical exploration of data: extensive brushing tools with animation, fitting, smoothing, overlaying, spectral planes, projections, layered compressions, marked subsets ■ Price **$995.**

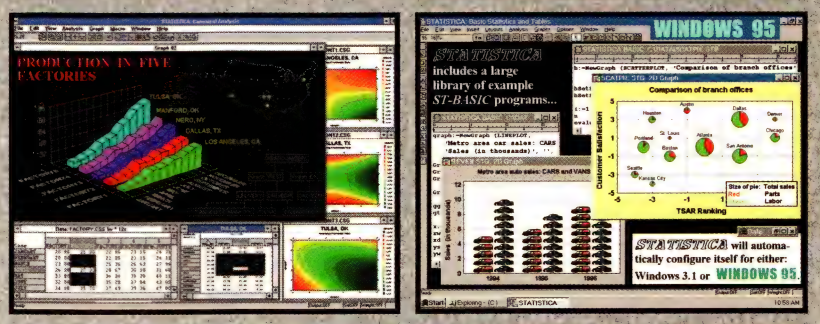
Quick STATISTICA (for Windows) ■ A subset of *STATISTICA*; comprehensive selection of basic statistics and the full analytic and presentation-quality graphics capabilities of *STATISTICA* ■ Price **$495.**

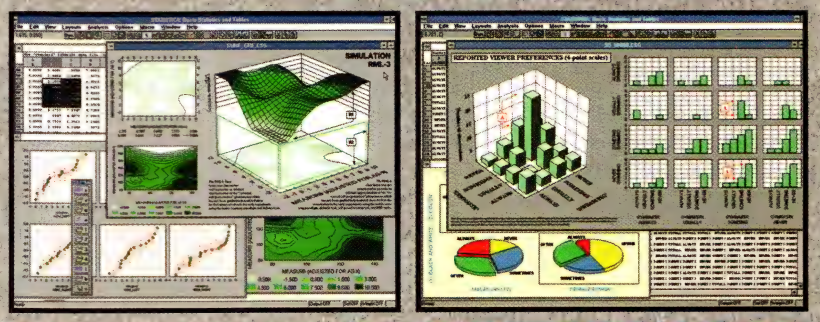
STATISTICA/QC – *Industrial statistics add-on package* (requires *STATISTICA* or Quick *STATISTICA* for Windows) ■ The largest selection of industrial statistics in a single package; quality control charts (compatible with real-time data acquisition systems), process capability analysis, R&R, sampling plans, and an extremely comprehensive selection of experimental design (DOE) methods ■ Flexible tools to customize and automate all analyses and reports (incl. "turn-key" system options, and tools to add custom procedures) ■ Price **$495.**

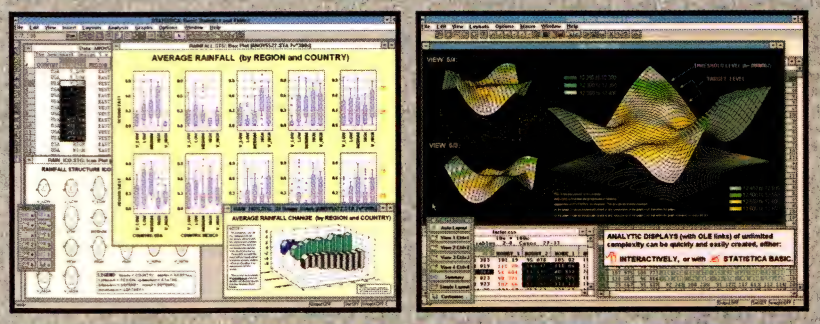
STATISTICA/Mac (for Macintosh) ■ Price **$695** (Quick - **$395**).

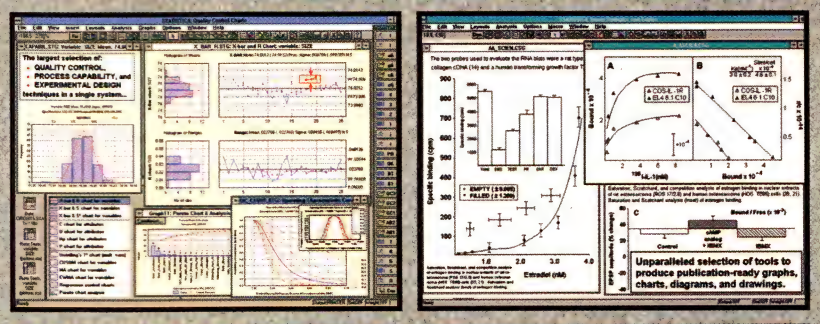
Domestic sh/h $12 per product; 30-day money back guarantee.

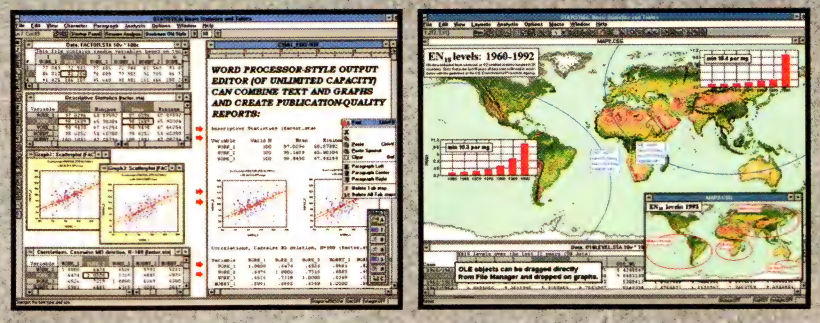












StatSoft®

2325 E. 13th St. • Tulsa, OK 74104 • (918) 583-4149
Fax: (918) 583-4376

Overseas Offices: StatSoft of Europe (Hamburg, FRG), ph: 040/ 4200347, fax: 040/4911310; **StatSoft UK** (London), ph: 01462/482822, fax: 01462/482855; **StatSoft Pacific** (Melbourne, Australia), ph: (03) 663 6580, fax: (03) 663 6117; **StatSoft France** ph: (1) 45 66 97 00, fax: (1) 45 66 06 51; Available from other Authorized Representatives worldwide: Sweden: AkademiData Scientific ph: 018-210035, fax: 018-210039; Finland: Statcon Oy ph: 24-334678, fax: 24-333867; Belgium: Texma NewTech ph: 010 61 16 28, fax 010 61 69 57; South Africa: Osiris ph: 12-663-4500, fax 12-663-6114; Japan (Macintosh): Three's Company, Inc., ph: 03-3770-7600, fax 03-3770-7784; Japan (Windows): Design Technologies, Inc., ph: 03-3667-1110, fax: 03-3668-3110; Italy: Prompt SRL ph: 49-893-3227, fax: 49-893-2897; Poland: Companion Oprogramowanie ph: 12-369680, fax: 12-360791; Taiwan: Intelligent Integration Corp. ph: 2-759-1791, fax: 2-759-1790.

StatSoft, the StatSoft logo, STATISTICA, and Scrollsheet are trademarks of StatSoft, Inc.

Circle 254 on Inquiry Card.

The Data Gold Rush

ucts—whether they have true DM capabilities or not. This hype cloud is creating much confusion about data mining. In reality, data mining is the process of sifting through vast amounts of information in order to extract meaning and discover new knowledge.

It sounds simple, but the task of data mining has quickly overwhelmed traditional query-and-report methods of data analysis, creating the need for new tools to analyze databases and data warehouses intelligently. The products now offered for DM range from on-line analytical processing (OLAP) tools, such as Essbase (Arbor Software) and DSS Agent (MicroStrategy), to DM tools that include some AI techniques, such as IDIS (Information DIscovery System, from IntelligenceWare) and the Database Mining Workstation (HNC Software), to the new vertically targeted advanced DM tools, such as those from AT&T Global Information Solutions. (See "A Data Miner's Tools" on page 91 for more information on DM products.)

Many people argue that the OLAP tools are not "true" mining tools; they're fancy query tools, they say. Since these programs perform sophisticated data access and analysis by rolling up numbers along multiple dimensions, some analysts still include them in the category of top-down mining tools. The market has yet to see much in the way of more-advanced mining tools, although the spigot is being turned on by application-specific DM tools from AT&T, Lockheed, and GTE.

Let's Get Vertical

One major DM trend is the move toward powerful application-specific mining tools. "There is a trade-off in the generality of data-mining tools and ease of use," observes Gregory Piatetsky-Shapiro, principal investigator of the Knowledge Discovery in Databases Project at GTE Laboratories. "General tools are good for those who know how to use them, but they really require lots of knowledge to use them."

AT&T, for example, recently introduced Sales & Marketing Solution Packs to mine data warehouses. They're tailored to vertical markets in retail, financial, communications, consumer-goods manufacturing, transportation, and government. These programs provide about 70 percent of the solution, with final tailoring required to

The U.S. Internal Revenue Service has developed a system to detect fraud and improve tax collections. The prototype system runs on PCs and includes KnowledgeSeeker (Angoss Software), ModelWare (TeraNet), and AIM (AbTech).

Beverly Cook, a researcher at the University of Wisconsin-Milwaukee, used IDIS to evaluate the death penalty–related votes and opinions of Supreme Court Justice Byron White. She found that his behavior was related to his affiliation with the conservative bloc of the Court and that his voting patterns were linked to the race of the accused.

GTE Laboratories has built an advanced DM system to evaluate health-care utilization costs for GTE's employees and dependents. Health-KEFIR (KEy FIndings Reporter) pinpoints groups whose costs are likely to increase in the coming year, finding areas where specific intervention strategies are likely to save the most money. The system can slice and dice the data in thousands of different ways—by business units, age groups, or types of care, for instance. It can consider multidimensional factors for each subcategory of data, such as payments per day per hospital stay within various segments. (See the figure "The KEFIR System.")

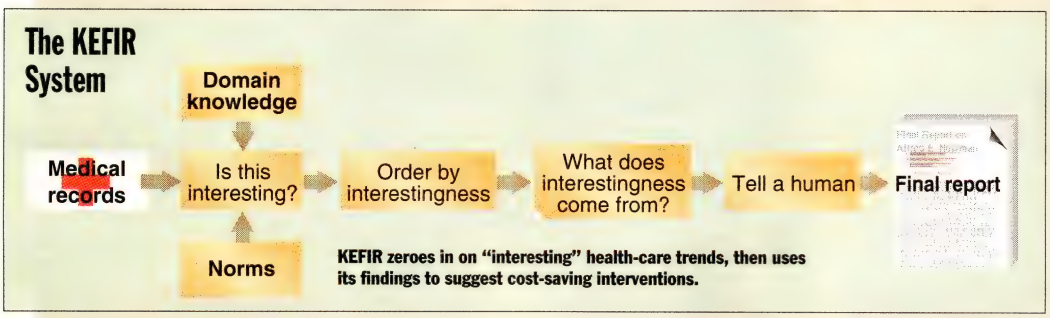
Health-KEFIR selects only those medical conditions that are "interesting"; in other words, those for which there is a known procedure that improves health outcomes and decreases costs. An increase in normal pregnancies, for example, will not be flagged, while an increase in premature births will be flagged, since there are standard medical interventions in prenatal care taken to reduce the premature birth rate.

"KEFIR's reports are more comprehensive, generated in less time, and significantly cheaper than comparable medical consultant reports," claims Gregory Piatetsky-Shapiro, principal investigator of the Knowledge Discovery in Databases Project at GTE Laboratories.

KEFIR is written in tcl and C, with a SQL interface to ensure portability. It currently runs on a Sun SparcStation 20 workstation with Informix DBMS. Instead of a paper report of hundreds of pages, KEFIR's output is on the network in hypertext markup language (HTML) and GIF files, accessible by Web client software such as Netscape's Mosaic. Deployment to GTE regional managers across the country is scheduled for late 1995. GTE is now evaluating proposals to turn Health-KEFIR into a commercial product. It is also considering applying KEFIR to marketing and customer-analysis tasks.

Southern California Spinal Disorders Hospital in Los Angeles is using IDIS (IntelligenceWare) on PCs to discover subtle factors affecting success and failure in back surgery.

A coach in the U.S. Gymnastics Federation is using IDIS to discover long-term factors that contribute to an athlete's performance. This information will be used in order to treat potential problems early on.



KEFIR zeroes in on "interesting" health-care trends, then uses its findings to suggest cost-saving interventions.

lor blends look airbrushed, printed on the ly desktop color laser with continuous e. Legal-size. Gorgeous!

redibly precise color accuracy. Full-page tabloid-bleed. True to the numbers!

Info-rich report graphics on plain or glossy paper. Up to 4 pages per minute! The fastest color yet.

High impact, business-building overheads and reports. Up to 600 x 300 dpi. Desktop option switches paper and transparencies. A bigger piece of the pie will be coming your way!

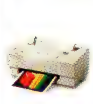
Vibrant covers, color prints and comps. Full-bleed tabloid. Front and back. Any paper, vellum to cover.

Color is color, until you compare the best.

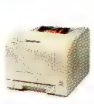
These are the color printers of Tektronix, the best in the world. For all the colorful things you do in business, graphic arts, science and engineering, there's a Phaser Color Printer that fits your requirements perfectly. Among these Phasers are the ones designated Editors' Choice by *PC Magazine*. "All five offerings from the [Tektronix] Phaser line define the state of the art in their respective categories."* Now four new Phasers raise those standards even higher than before.

All Phaser Color Printers offer:

■ 300 dpi or 600 dpi ■ Adobe PostScript™ Level 2 ■ Paper prints or transparencies ■ Support for PCs, Macs, workstations and networks ■ Pantone's color certification ■ RISC-speed print processing ■ TekColor™ image enhancement ■ A Tektronix one year warranty ■ Top technical support.


Phaser 140

NEW Phaser 240


NEW Phaser 340

NEW Phaser 540 Plus

Phaser 300i / III

Phaser 440

NEW Phaser 480X

Tektronix

Call 800/835-6100, Ext. 1223.
http://www.tek.com/CPad?1223

© 1995 Tektronix, Inc. All rights reserved.
*PC Magazine, Nov. 22, 1994, Annual Printer Review.

Circle 102 on Inquiry Card.

The Data Gold Rush

DM techniques are starting to assist humans in scientific discovery. By traversing enormous data sets, they are finding patterns in molecular structures, genetic data, global climate changes, and more.

NASA-Jet Propulsion Laboratory and Caltech have developed SKICAT (SKy Image Cataloging and Analysis Tool), an advanced DM system to automatically analyze and catalog the second Palomar Sky Survey of the northern heavens. (SKICAT is written in C, runs under Unix, and employs custom algorithms and a Sybase DBMS.) When complete, the survey will catalog more than 50 million galaxies, about 2 billion stars, and 100,000 quasars. The survey will produce some 3 terabytes of data, which will be reduced to a galaxy catalog.

SKICAT recently discovered nine new quasars. With previous search techniques, it took three years to discover a similar number of the same type of quasars. With SKICAT, Caltech astronomers performed the same feat in less than six months using at least an order of magnitude less of observing time.

fit the individual client's needs, AT&T says. Complete with AT&T parallel hardware, software, and some services, Solution Packs start at around $250,000.

Both GTE and Lockheed Martin may shortly follow suit. GTE is already entertaining proposals to turn its Health-KEFIR (KEy FIndings Reporter) into a commercial product (see the "Health Care" text box on page 86). The Artificial Intelligence Research group at Lockheed Martin has been investigating and developing DM tools for the past 10 years. Recently, the Lockheed group built an internal application-development tool, called Recon, that generalizes their DM techniques, then applied it to application-specific problems. A beta version of the first vertical packages—for finance and marketing—will be available in 1996. The system has an open architecture, running on Unix platforms and massively parallel supercomputers. It interfaces with existing relational database management systems, financial databases, proprietary databases, data feeds, spreadsheets, and ASCII files.

In a similar vein, several neural network tools have been customized. Customer Insight Co., for instance, has built an interface to link its Analytix marketing software with HNC Software's neural network–based Database Mining Workstation, creating a marketing DM hybrid. HNC Software's Falcon detects credit-card fraud; according to HNC, the program is watching millions of charge accounts.

Invasion of the Data Snatchers

The need for DM tools is growing as fast as data stores swell. More-sophisticated DM products are beginning to appear that perform bottom-up as well as top-down mining. The day is probably not too far off when intelligent agent technology will be harnessed for the mining of vast public on-line sources, traversing the Internet, searching for information, and presenting it to the human user. Microelectronics and Computer Technology Corp. (MCC, Austin, TX) has been pioneering work in this area, developing a platform, called Carnot, for its consortium members. Carnot-based agents have been successfully applied to both top-down and bottom-up DM of distributed heterogeneous databases at Eastman Chemical.

"Data mining is evolving from answering questions about what has happened and why it happened," observes Mark Ahrens, director of custom software sales at A.C. Nielsen. "The next generation of DM is focusing on answering the question 'How can I fix it?' and making very specific recommendations. That's our focus now—our Holy Grail." Meanwhile, the gold rush is on. ■

Although there are reportedly a number of financial applications using DM techniques, the financial community is understandably tight-lipped about them. Numerous investment companies, for example, pick stocks with advanced DM systems, while some financial institutions have implemented systems designed for prevention and detection of fraud.

Security Pacific/Bank of America uses DM to help with commercial lending decisions and to prevent fraud.

MINING OTHER DATA-MINING RESOURCES

Information about DM research, applica-tions, and tools can be found on the Knowledge Discovery Mine Website at http://info.gte. com/~kdd/.

Advances in Knowledge Discovery & Data Mining, U. Fayyad, et al., editors; AAAI/MIT Press, 1995.

Proceedings of the First International Conference on Knowledge Discovery and Data Mining, U. Fayyad, et al., editors; AAAI Press, 1995.

Sara Reese Hedberg is a freelance writer who lives in Issaquah, Washington. She has written extensively about emerging computer technologies. She can be reached at editors@bix.com.

Product Information

Analytix . . . . . $100,000 and up
Customer Insight Co.
Englewood, CO
(800) 262-5989
(303) 790-7002
fax: (303) 643-1535
Circle 1160 on Inquiry Card.

Database Mining Workstation $51,000
(for software and PC board, processing, and training)
HNC Software
San Diego, CA
(619) 546-8877
fax: (619) 452-6524
pdc@hnc.com
Circle 1161 on Inquiry Card.

Falcon . . . . . $250,000–$1 million
HNC Software
(see above)
Circle 1162 on Inquiry Card.

IDIS
PC. $1900
Server. . . . depends on number of records to be processed (e.g., 1 million records, $25,000)
IntelligenceWare
Torrance, CA
(310) 782-3340
fax: (310) 782-7565
datamine@ix.netcom.com
Circle 1163 on Inquiry Card.

Prism . . . . . $400,000–$1 million
Nestor
Providence, RI
(401) 331-9640
fax: (401) 331-7319
Circle 1164 on Inquiry Card.

Spotlight . . . . . site license
A.C. Nielsen
Schaumberg, IL
(708) 605-5000
Circle 1165 on Inquiry Card.

CompuServe gives you the Internet.

[As if our 3,000 online services weren't enough.]

NEW! Lower hourly rates.

What do you get when you combine the world's largest online service and the vast network of 30 million Internet users? The simplest way to connect to the whole world at once. Because now CompuServe gives you one-stop access to the Internet. And to prove it's the easiest way to connect to people and information worldwide, we'll give you free hours of exploration time. Every month.

With a membership to CompuServe, you get thousands of engaging services. Like *Sports Illustrated*, *People* magazine, music and movie clips, CNN Online, Roger Ebert reviews, games, Wall Street reports, and professional and technical forums. You also get all the Internet extras: the World Wide Web, USENET, FTP, and e-mail. And you can use our award-winning software, NetLauncher,™ to easily navigate the web.

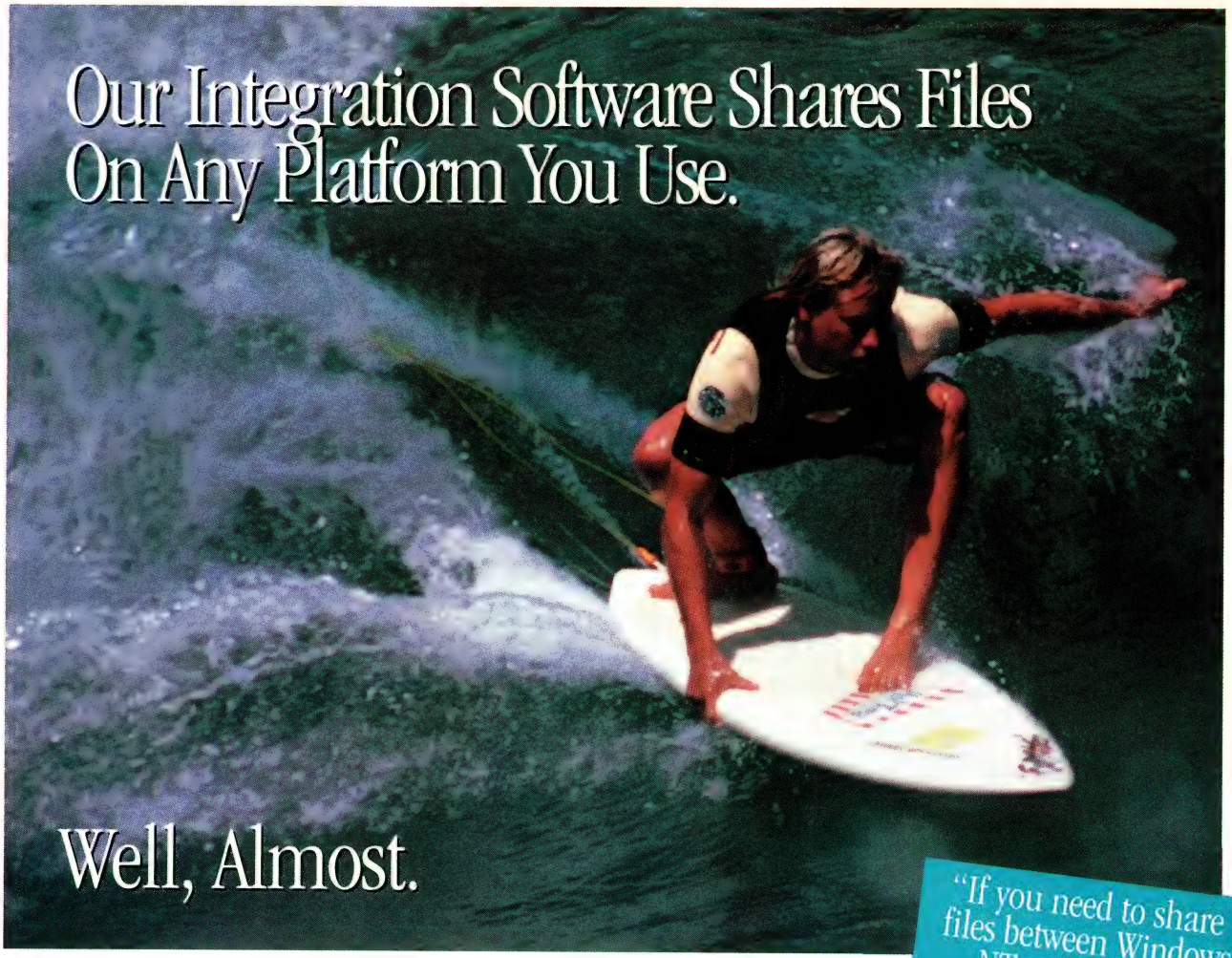
With more to offer and reduced hourly rates, you get the best online value from CompuServe. Just call the *Byte* representative at 1-800-487-4838 to receive:

1. A free membership kit: CompuServe Information Manager software for DOS, Macintosh, Windows, or OS/2.
2. One free month of CompuServe membership (a $9.95 value).
3. Five free hours each month, including the Internet. Additional online time is now only $2.95 per hour!
4. BONUS! Five additional hours online during your first month of membership for a total of 10 free hours.

CompuServe®

The information service you won't outgrow.™

Circle 67 on Inquiry Card.



"If you need to share files between Windows NT and UNIX or another NFS system, these excellent products will do the job with a minimum of fuss."—
Open Systems Today 11/28/94

Four Great Products For Simple File And Disk Sharing Across Multiple Platforms.

Intergraph's full line of Windows NT and UNIX integration products makes it easy to cross platforms. Streamline client/server networks. And simplify every system manager's life.

PC-NFS for Windows NT. Lets Windows NT users access files and resources on UNIX servers and workstations. And connect to corporate databases and mail systems. From the familiar Windows interface.

DiskShare for Windows NT. Lets UNIX NFS users access files and directories on Windows NT servers and workstations. While taking advantage of UNIX utilities to manage files on Windows NT seats. With Windows point-and-click interface.

eXalt for Windows NT. Lets eXalt users move quickly between X-based applications and Windows NT. Without cumbersome text-file editing. Using a Microsoft Windows, Open Look, OSF/Motif or twm look-and-feel.

Batch Services for Windows NT. Lets Windows NT users schedule, manage and reschedule non-interactive jobs. Locally or network-wide. With the Windows interface.

Total Support. 100% Satisfaction Guaranteed. Like all Intergraph software, these integration applications come with the industry's top-ranked support. And a 30-day, 100% satisfaction guarantee. Call 1-800-291-9909 for your nearest reseller.

Call 1-800-291-9909
For Free Evaluation CD.

INTERGRAPH®
SOFTWARE SOLUTIONS

SunSelect, the Sun logo, NFS and ONC are trademarks or registered trademarks of Sun Microsystems, Inc. Intergraph is a registered trademark of Intergraph Corporation. Microsoft, Windows NT, and the Windows logo are trademarks or registered trademarks of Microsoft Corporation. Other brands and product names are trademarks of their respective owners. © 1995 Intergraph Corporation, Huntsville, AL 35894-0001.

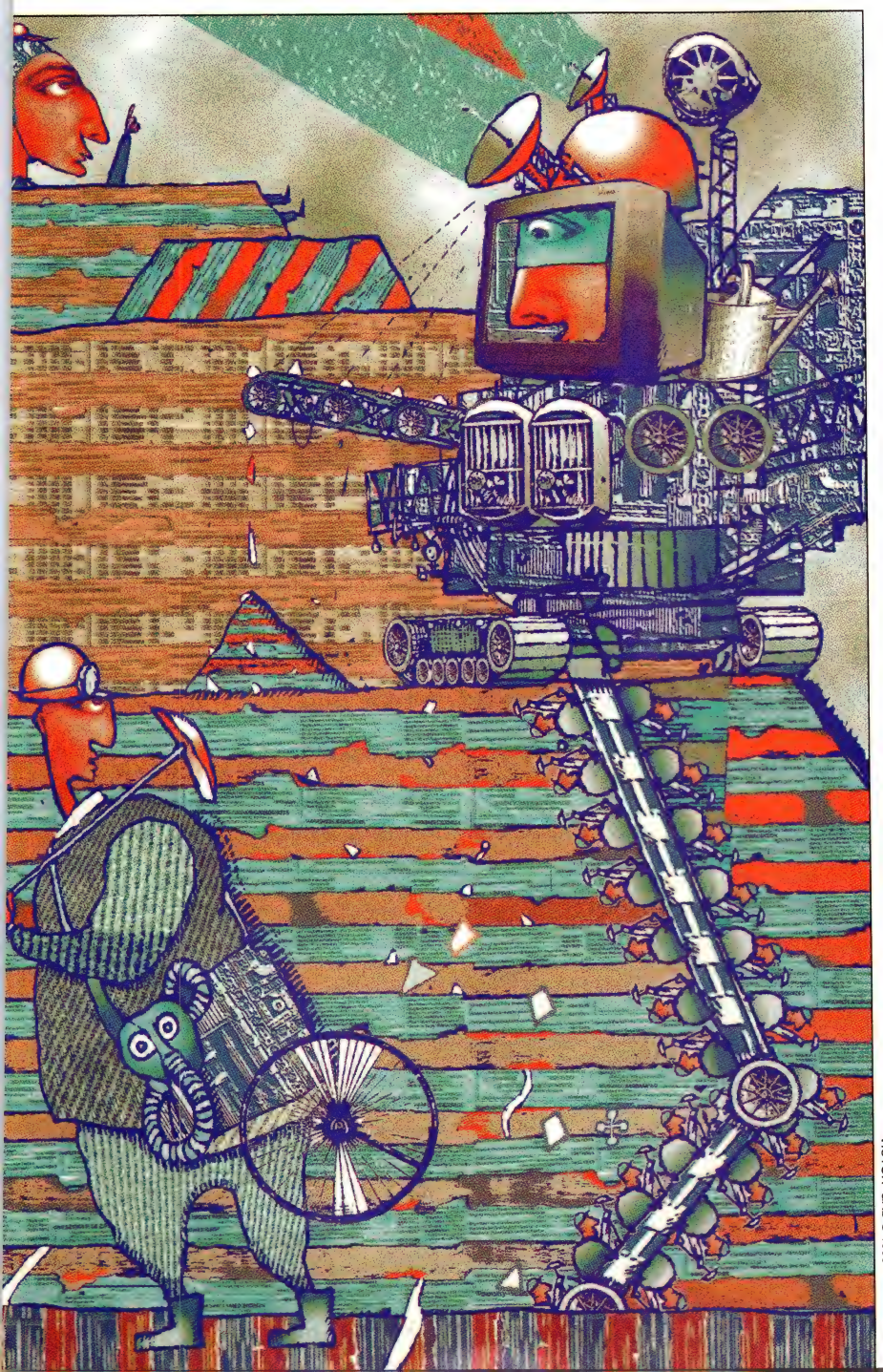
MICROSOFT WINDOWS COMPATIBLE 32-Bit Application

Circle 74 on Inquiry Card (RESELLERS: 75).

A DATA MINER'S TOOLS

Intelligent agents, multidimensional analysis tools, and good old database queries all belong in the well-equipped data miner's toolbox

KAREN WATTERSON



VICTOR GAD © 1995

Put down that pickax, Eugene. Mining the information nuggets from your data requires specialized tools. Some are brand new, and some are borrowed from other sources; some are as dumb as bricks, and some seem to have minds of their own.

Even if your job description doesn't say anything about data mining (DM)—yet—the fact is that most information workers spend much of each day performing DM. The right tools can give your data miners that extra edge. As Don Keough, former president of Coca-Cola, might add to any discussion of DM, "Who[ever] has information fastest and uses it wins." So grab your helmet and check out what the well-equipped data miner is using.

Talk to My Agent

Remember Bill Gates's vision of "information at our fingertips"? Well, the truth is that most of us have information up to our eyeballs and probably receive more in a week than we could process in several lifetimes. One challenge of DM is to develop intelligent agents that can prioritize and/or filter the data bombarding us daily, including our overflowing E-mail. But DM is also about revealing new relationships and patterns and using software agents that will do the mining for us, often performing the screening and fetching functions of yesterday's secretaries and clerks.

The notion of harnessing computers to perform tedious chores is as old as science fiction. Have you ever tried to identify buying patterns of high-margin customers? Or look for patterns that may be indicators of fraud? Do you use an Internet clipping service to provide you with a personal news summary? Or alert you to wire-service announcements related to a key competitor? If the answer to any of these questions is yes, you're already dealing with the tasks of intelligent agents.

Several categories of intelligent agents

are available. Some are launched manually to perform specific queries or to search for patterns in data. Others fire off automatically at predefined intervals, performing a task or monitoring a condition in the background and returning an alert as required. Most intelligent agents are simply short programs that say "if this happens, do that."

A handful of DM tools are sometimes lumped together under the rubric information discovery or knowledge discovery. They often have a resemblance—algorithmically speaking—to expert systems or AI. Most of these autonomous tools are low-touch but high-tech.

As Adam Szladow, president of Reduct Systems, a firm that markets rule-generating software, says, "One wants to get strong, repetitive patterns, patterns that occur with some frequency." One Reduct customer discovered rules for predicting business creditworthiness based on a database that had only a few hundred cases.

Mining for Dollars

For some people, intelligent agents are the sine qua non of DM. Barry Mason, who is a principal with IBM's Consulting Group, defines DM as "discovery tools which take large amounts of detailed transaction-level data and apply mathematical techniques against it, 'finding' or discovering insights into consumer behavior."

For Mason, DM is the first step in a series of activities that can lead to new actionable business intelligence. IBM has proprietary, patent-pending techniques to analyze gigantic data sets for cross-marketing or affinity marketing and look for patterns. These patterns may be so nonobvious as to appear almost nonsensical, such as that people who have bought scuba gear are good candidates for taking Australian vacations.

Other products, such as the DataEngine from MIT GmbH, use fuzzy logic and neural-network algorithms to do DM that helps analyze and control real-time technical processes. DataEngine, a programmer's tool not intended for casual end users, includes a visualization component that can provide hints about process bottlenecks, for example.

Reduct's Data/Logic products also ferret out patterns, automatically generating rules that can be probed using varying degrees of boundary "roughness," a technique akin to fuzzy set analysis. Wall Street analyst Murray Riggiero Jr. used Data/Logic in conjunction with neural-network software to generate rules for his trading system.

IntelligenceWare's automatic information-discovery tool, IDIS, also looks for correlations. It forms, tests, and modifies its own hypotheses until classification rules or rules with intervals, or more inexact rules, emerge. IDIS has been used successfully in applications ranging from fraud detection to consumer loan analysis to optimizing production lines.

Most humans are better at detecting anomalies than inferring relationships from large data sets, and that's why information discovery can be so useful. Rather than relying on a human to come up with hypotheses that can be confirmed or rejected based on the evidence (i.e., data), good discovery tools will look at the data and essentially generate the hypotheses.

A Dimension of Mine

Do you use your spreadsheet's crosstab or pivoting features? Have you explored data using slice-and-dice techniques to examine it from different perspectives and in varying amounts of detail? If so, you've encountered another part of the DM toolbox: multidimensional analysis (MDA), or online analytical processing (OLAP), tools.

Bruce Love of the Gartner Group has described DM as "an intensive search for new information and new combinations pursuing defined paths of inquiry and allowing unexpected results to generate new lines of analysis and further exploration." Love is clearly thinking of iterative exploratory techniques of data surfing using MDA or OLAP tools. MDA represents data as *n*-dimensional matrices called hypercubes. OLAP and related hypercubes

Selecting Data-Mining Tools

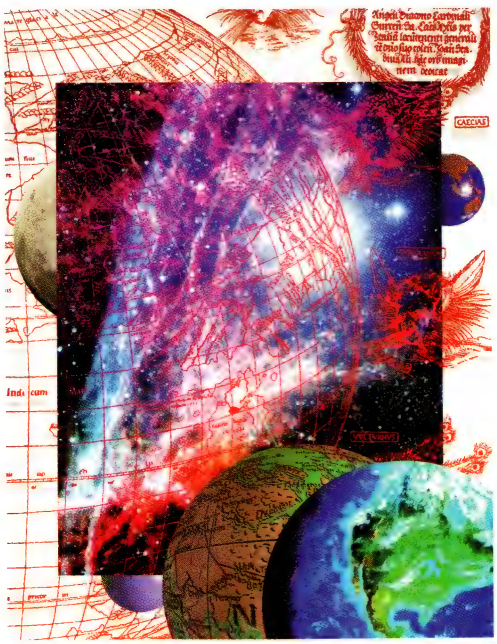
Intelligent agents require some expertise to set up but need little direction. Some work directly on text. Best used for turning up unsuspected relationships. Don't turn these things loose on production systems, though.

Multidimensional-analysis (MDA) tools can have simple graphical interfaces for nonexpert use. Work on databases but really zip with multidimensional hypercubes of data (special setup). Best use: iterative, interactive, hands-on exploration of data.

Query-and-reporting tools require close direction to frame queries (many simplify the process with graphical interfaces). Require a database structure. Best use: asking specific questions to verify hypotheses. Legendary for their ability to bog down production systems.

Compex Portable Ethernet.

Stay connected wherever you go.



Now staying connected is easier then ever—wherever you go—with portable Ethernet products from Compex. **New ENET-MCIA Combo** PCMCIA card lets you:

- Load a LAN in a laptop
- Data transmission speeds of a desktop node
- "Hot swap" support for user-friendly card removal and reinsertion while preserving system status.
- 10 Base T or 10 Base 2 cabling
- Low suggested retail price.

ParaPort. The pocket LAN adapter that combines exclusive features and low cost that has won rave reviews.

- Exclusive ThruPort™, printer pass-through port lets you to connect to a PC without loosing your printer port.
- EPP compatible
- Power from keyboard connector
- UTP, or Coax and UTP versions.

#1 RATED ★★★★★ 9.0 PC Digest RATINGS REPORT Compex ParaPort-E April 1994

- Priced at about half the cost of the competition. Compex has always out-connected the rest with high performance Ethernet products. Now with new ENET-MCIA and ParaPort, Compex make staying connected easier than ever.

Find out more!

COMPEX®

Out-connecting the rest

yes NetWare

MICROSOFT WINDOWS COMPATIBLE

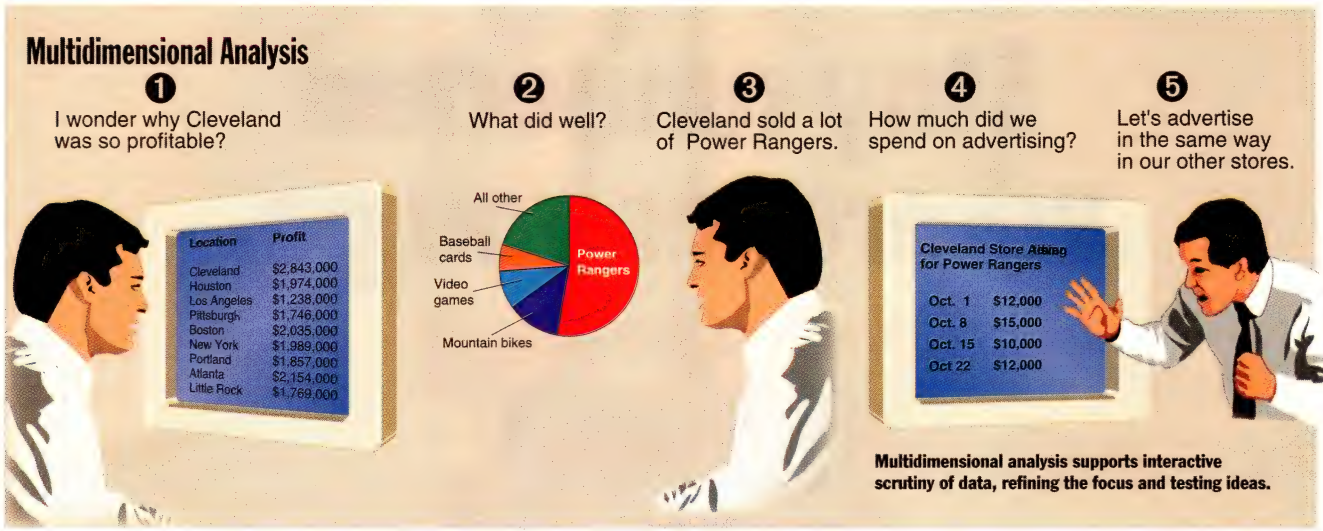
© 1995 Compex, Inc. Compex is a registered trademark of Compex, Inc. ParaPort and ENET-MCIA are trademarks of Compex, Inc. All other trademarks and copyrights acknowledged.

U.S.A.
COMPEX, Inc.
4051 E. La Palma
Anaheim, CA 92807 U.S.A.
(714) 630 7302
Fax (714) 630 6521

GERMANY
ReadyLINK Networktechnology GmbH
Albert Einstein Strasse 42
63322 Rödermark, Germany
(49) 6074 98017
Fax: (49) 6074 90668

SINGAPORE
COMPEX Systems Pte Ltd
4 Kim Chuan Terrace,
Singapore 1953
(65) 288 8220
Fax (65) 280 9947

Circle 503 on Inquiry Card (RESELLERS: 504).



Multidimensional analysis supports interactive scrutiny of data, refining the focus and testing ideas.

let users iteratively calculate metrics such as sales, revenue, market share, or inventory over a subset of available data, by exploring combinations of one or more dimensions of data.

The idea is to load a multidimensional server with data that is likely to be combined. Imagine all the possible ways of analyzing clothing sales: by brand name, size, color, location, advertising, and so on. If you fill a multidimensional hypercube with this data, viewing it from any 2-D perspective—n-dimensional hypercubes have $n*(n–1)$ sides, or views—will be easy and fast.

That's the appeal of products from vendors such as Arbor Software (Essbase), Comshare (Commander OLAP), Oracle/IRI Software (Express EIS), and Pilot Software (Lightship). Karl Stephan, a senior financial manager in Sears's planning analysis section, remembers when it took hours to assemble the data he needed into a spreadsheet. Using Essbase, it takes just seconds. Delta Airlines has used OLAP to gain insights into its frequent-flier program. Using Planning Sciences' Gentium, it's consolidated data from a 100-GB Teradata database into six far more accessible multidimensional databases totaling a mere 6 GB.

OLAP servers are great for time-series analyses, recursive calculations (e.g., how to allocate overhead as a percent of revenue contribution by product line), and data with up to about 15 dimensions. Beyond that, most multidimensional servers fail under the sheer weight of their own indexes. Michael Saylor, president of OLAP vendor MicroStrategy, segments the DM market into three parts. He recommends spreadsheets and query tools for slice-and-dice data mining on databases of up to about 1 GB, departmental OLAP servers for up to about 20 GB, and enterprise warehouses for anything above that.

George Zagelow, program manager for data-warehousing solutions at IBM, concurs that most businesses need more than a single DM tool. "Multidimensional databases, OLAP products, DM, and traditional decision-support tools all belong in your toolbox right alongside standard relational databases."

For example, rather than use an OLAP or hypercube tool, you're better off creating a warehouse using a relational database if you have lots of data or are facing complex loading and consolidation from multiple data sources. Why? Because there's a mature utility market to support those activities. However, don't expect mining operations that represent joins across many multirow tables to be fast. That's where OLAP servers shine, providing blindingly fast results to queries along predefined dimensions.

Hypercubes vs. Killer Queries

Let's say you decide to mine your existing database to find the customers most likely to respond to a mail-order promotion. You might try using a query-and-reporting tool such as Information Builders' Focus Reporter or Software AG's Esperant to construct the SQL query, "How many credit-card customers who made purchases of over $100 on sporting goods in August have at least $2000 of available credit?" If the number is too big, you might refine it: "Narrow it down to customers under 40 who live within 30 miles of a store in a coastal state."

Although you can construct queries such as these using query-and-reporting tools that work with relational databases, such unfettered querying can bring a production system to its knees. That's why DM operations are usually made against data that's been warehoused, either in a traditional relational database or consolidated into a multidimensional hypercube.

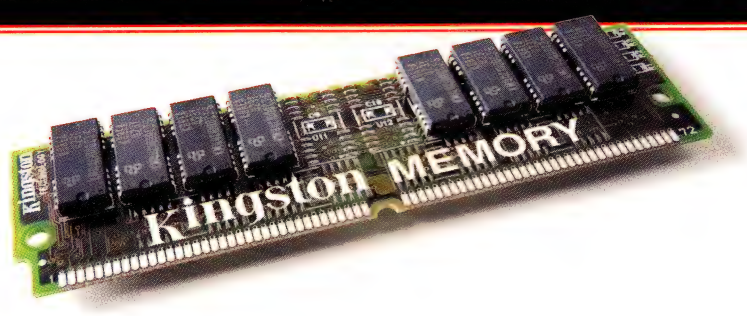
Although the relational/OLAP wars may continue for another year, chances are we'll see some convergence. Already, relational warehouses and virtual OLAP servers based on the relational model are adding support for star schemata. The idea is to mimic multidimensionality by creating special tables that contain roll-up data. For example, you might have a central fact table with sales data, surrounded by star tables with location, time, and product data. An innovation from Cross/Z International uses fractals to store warehouse data. The idea behind Fractal Database Mining System is to provide OLAP-style responses for huge data warehouses.

Because adding intelligent-agent capability to software isn't that complicated, most of today's OLAP products and query-and-reporting tools (e.g., Brio Technology's BrioQuery, Comshare's Commander OLAP with Detect and Alert, Information Advantage's NewsLine 3.0, and Trinzic's Forest & Trees) have this sort of intelligent agent built in. Comshare's Detect and Alert "robots" monitor news feeds or even Lotus Notes databases for keywords and stock quotes from Dow Jones News/Retrieval for predefined values.

With Forest & Trees, an administrator sets up alarms for trigger values. Many warehouse and middleware products (e.g., Trinzic's InfoPump) include intelligent agents that schedule data transfer from

Thinking Windows?

Think memory. Think Kingston.



Windows® NT. Windows 95. OS/2. All the hype about these powerful, new operating systems overlooks one tiny fact—most PCs and servers simply can't run them unless you add more memory. But Kingston can help you meet the demands of today's memory-hungry software, no matter what kind of systems you have.

You see, Kingston makes memory modules for more than 2,300 kinds of PCs, workstations, and printers. Not just all of the newest models from the leading brands, we make memory for all of the older systems too. Plus, we're the only ones who actually test 100% of our memory. And all of it comes with a lifetime guarantee.

How can you find the right memory configuration for your particular systems? That's easy. We make an electronic guide that helps find the exact memory you need in seconds. It's called the KEPLER configuration guide and it comes on a convenient, new Windows CD. You can get it free by calling (800) 251-9058. Or download it from our BBS by calling (714) 435-2636 or from CompuServe by typing GO KINGSTON.

Kingston TECHNOLOGY CORPORATION

For information on our memory products, call (800) 251-9058.

Kingston Technology Corporation, 17600 Newhope Street, Fountain Valley, CA 92708 USA, (714) 435-2600, Fax (714) 435-2699.

© 1995 Kingston Technology Corporation. Kingston Technology is a registered trademark of Kingston Technology Corporation. All rights reserved. Windows is a registered trademark of Microsoft in the U.S. and other countries. All other products or services are the trademarks or registered trademarks of their respective holders.

Circle 76 on Inquiry Card (RESELLERS: 77).

production systems to decision-support databases.

Mining with Query Tools

If you don't have an OLAP server or an enterprise data warehouse, don't despair. Lots of mining can be done from the desktop using client/server generation query-and-reporting tools. With many products available (e.g., Business Objects, Powersoft's InfoMaker, and Crystal Service's Crystal Reports), it's hard to differentiate among them. They range from traditional spreadsheets to products from vendors such as IQ Software and Cognos that provide strong support for MIS oversight.

Most of these tools come with graphing components. Some even support a degree of multidimensionality, such as pivoting, intelligent drilling, crosstab reporting, and time-series analysis. A few are beginning to offer easy-to-use intelligent-agent support (versus alerts that can be established programmatically). If you need to select a new query-and-reporting tool and need to support a mixed environment of PCs and Macs, be sure to make that a feature on your checklist.

You should think of query-and-reporting tools as generic mining tools. They generally support direct access to source data and may offer cross-database joins, but their unbridled use can wreak havoc with production systems. And, given the challenges of performing joins across systems, it may be hard for end users to know if the answer they're getting is accurate.

Query tools can be used for interactive exploration, especially against relational data. Most query tools construct SQL queries for the data miner and can be slow if the source data is scattered among many tables—especially large ones, on multiple databases, that are poorly indexed.

Tooling Up

DM is such a hot concept that it's showing up in nonspecialized tools. For example, high-end financial and statistical analysis, decision-support, and EIS vendors are adding DM capability (or, at least, labeling) to their products. Also, enterprise database vendors such as IBM and Hewlett-Packard are creating data- warehouse suites (IBM's Visual Warehouse) or virtual-warehouse frameworks (HP's Open Warehouse) that include—you guessed it—DM tools.

Converging from the desktop are spreadsheets and query-and-reporting tools associated with client/server applications. These tend to be high-touch tools, although many let users set up hands-off intelligent-agent alerts.

IntelligenceWare's Kamran Parsaye views DM and decision support as a set of fairly distinct spaces, each with its own set of algorithms. This includes an aggregation space containing precomputed OLAP data (to answer such questions as "What is the trend in Joe's sales by product and by month compared with average sales figures?"), an influence or discovery space (where relationships are discovered and refined), and a related variation space (for questions such as "How have weekly changes in prices varied over the last year?").

Because information-discovery tools have only recently gained widespread attention as DM tools, they still tend to be rather technical and best suited for analysts with strong mathematical backgrounds. Look for explosive growth in this area of DM tools as better user interfaces make them easier for end users to harness. As for intelligent agents, especially agents as Internet gofers and E-mail filters, within a year, you'll wonder how you ever lived without them.

The popularity of DM shows that businesses are looking for new ways to let end users find the data they need to make decisions, serve customers, and gain a competitive advantage. If your workers aren't asking for better mining tools, you'd better ask why. ■

Karen Watterson is an independent San Diego–based writer and consultant specializing in client/server issues. She is the editor of two newsletters and the author of Visual Basic Database Programming *and* Client/Server Technology for Managers *(both from Addison-Wesley). You can reach her at 1119390@mcimail.com.*

Where to Find

Arbor Software Corp.
Sunnyvale, CA
(800) 858-1666
(408) 727-5800
fax: (408) 727-7140

Brio Technology, Inc.
Mountain View, CA
(800) 486-2746
(415) 961-4110
fax: (415) 961-4572

Business Objects, Inc.
Cupertino, CA
(800) 703-1515
(408) 973-9300
fax: (408) 973-1057

Cognos, Inc.
Burlington, MA
(800) 426-4667
(617) 229-6600
fax: (617) 229-9828

Comshare
Ann Arbor, MI
(800) 922-7979
(313) 994-4800
fax: (313) 769-6943
info@comshare.com
http://www
.comshare.com

Cross/Z International, Inc.
Uniondale, NY
(510) 522-4000
fax: (516) 228-8584
crossz@netcom.com

Crystal Services, Inc.
Vancouver, British
Columbia, Canada
(800) 877-2340
(604) 681-3435
fax: (604) 681-2934

Hewlett-Packard Co.
Cupertino, CA
(800) 637-7740
(408) 725-8900
fax: (408) 447-4458
http://www.hp.com

IBM
Somers, NY
(800) 547-1283
http://www.ibm.com

Information Advantage
Edina, MN
(800) 959-6527
(612) 820-0702
fax: (612) 820-0712
marketing@infoadv.mn.org

Information Builders, Inc.
New York, NY
(800) 969-4636
(212) 736-4433
fax: (212) 564-1726
info@ibi.com
http://www.ibi.com

IntelligenceWare
Los Angeles, CA
(800) 888-2996
(310) 216-6177
fax: (310) 417-8897
datamine@ix.netcom.com

IQ Software Co.
Norcross, GA
(800) 458-0386
(404) 446-8880
fax: (404) 448-4088
sales@mhs.iqsc.com

MicroStrategy
Vienna, VA
(800) 927-1868
(703) 848-8600
fax: (703) 848-8610
info@strategy.com

MIT GmbH
Aachen, Germany
+49 2408 9458 11
fax: +49 2408 948 2
info@mitgmbH.de

Oracle/IRI Software
Waltham, MA
(800) 765-7227
(617) 890-1100
fax: (617) 890-4660
iri.software@infores.com

Pilot Software
Cambridge, MA
(800) 944-0094
(617) 374-9400
fax: (617) 374-1110

Planning Sciences, Inc.
Littleton, CO
(303) 794-8701
fax: (303) 794-8702

Powersoft Corp.
Concord, MA
(800) 395-3525
(508) 287-1500
fax: (508) 287-1600
http://www.powersoft.com

Reduct Systems, Inc.
Regina, Saskatchewan,
Canada
(306) 586-9408
fax: (306) 586-9442

Software AG
Reston, VA
(800) 423-2227
(703) 860-5050
fax: (703) 391-6731
http://www.sagus.com

Trinzic Corp.
Redwood City, CA
(415) 591-8200
fax: (415) 594-8645

DATA-MINING DYNAMITE

Blasting loose those buried nuggets of information requires clean data, warehousing strategies, powerful parallel processors, and heaps of hard disk space

CHERYL D. KRIVDA

VICTOR GAD © 1995

Nothing loosens up that pesky nugget like a well-placed stick of dynamite. Similarly, there are ways in which you can significantly speed up and simplify your data-mining activities. Data-cleansing and data-fusion tools can transform bales of operational data into error-free, consistently formatted information. Data warehouses support storage and access on specialized servers. Parallel-processing techniques accelerate data mining's complex queries. And, when you have terabytes of data to stash, storage considerations are important, especially as the price of disk space plummets.

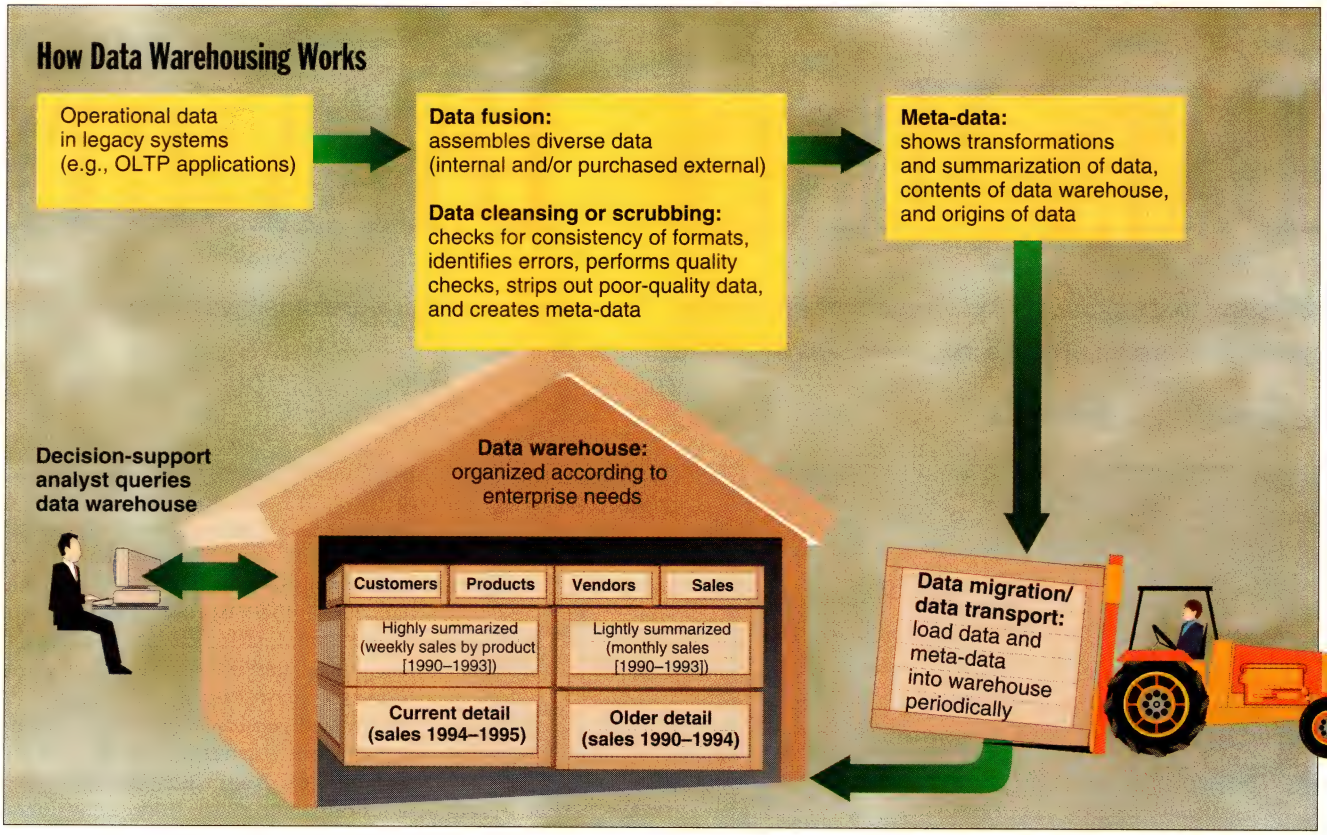
Why bother? Remember: The whole point of data mining is to reveal hidden information for prompt decision-making and action. And there's also the matter of the 1000 percent return on investment that some data-mining pioneers are enjoying.

Clean and Scrubbed

While preparing to initiate some data mining, one New York City merchant bank discovered that its databases contained up to 13 different representations of some customer's names, such as Andrew B. Jones/ Mr. A. Jones. This is but one example of a common problem: Databases storing a company's lifeblood information about customers and transactions are commonly rife with errors, duplicate data (or worse), and information that would not necessarily be useful to data-mining applications. One bank has already saved $170,000 per month that it had been spending on duplicate mailings by cleaning up its customer data and then housing it with associated account information, according to Peter Kastner, an analyst with the Aberdeen Group, a Boston-based market-research and computer-industry consulting firm.

For data-mining applications to produce valid results, data has to be cleaned of errors and "scrubbed" to create consistent formats (e.g., 1s and 0s become male and

Data-Mining Dynamite



female). The process can be a slow one. Although reasonably priced tools are available to reformat data, cleanse it, and prepare it for eventual migration to a data warehouse (explained later), information-systems (IS) management must also dedicate time to the effort of determining which format to use and how data should be represented before warehousing it.

The payoffs can be dramatic. One telephone company was able to mine its cleaned and warehoused data to identify 10,000 supposedly "residential" customers who spent more than $1000 per month on their phone bills. Investigating more closely, the telephone company discovered that these customers were really small businesses trying to avoid paying business rates for their service.

A Place for Everything

The mainframe: A nice place to visit, but you wouldn't want to mine there. For one thing, production mainframes often support day-to-day business activities (e.g., airline reservations) that you probably do not want to impede with your killer queries. In addition, you probably want a well-behaved data server that you can hang your mining clients from. Besides, the data structures on your mainframe probably aren't the best for the data-mining activities you want to perform.

Enter the *data warehouse*, a server-based replication of a mainframe's data. The server receives updated information from the mainframe periodically—monthly, weekly, or even daily, depending on needs. The database on the data-warehouse server then fields data-mining queries from the client machines independently of the mainframe.

A data warehouse provides an effective structure for data mining, explains Bill Inmon, cofounder of Prism Solutions (Sunnyvale, CA) and widely considered the originator of the data-warehousing concept. Without first warehousing its data, a company has lots of information that is not integrated and has little summary information or history. The effectiveness of mining such data, he says, is limited.

Think data warehousing sounds easy? In actuality, the difficulty of getting a data warehouse operational is one of the many reasons why sites building them typically engage outside expertise to facilitate the project. Although consultants with experience in designing and populating data warehouses are few and far between, and expensive when available, they are typically worth the investment, especially for high-profile projects.

Still, convinced that data cleansing and warehousing sound like jobs that their best analyst will be able to handle, some companies elect to go it alone. "We see a lot of cheap science projects," says Chuck Buffum, general manager of the decision-support business unit for Tandem Computers (Cupertino, CA).

One Fortune 100 company IS manager waited three years for his staff to complete a high-profile data warehouse, relates Dr. Kamran Parsaye, CEO of Information Discovery (Hermosa Beach, CA). When poor warehouse design prevented the company from successfully populating the warehouse with clean data, the IS manager directed his staff to mine the production data and deep-six the warehouse plans. "It was success by declaration," Parsaye says.

1000 Percent Return on Investment

For all the warnings about the dangers involved in building a useful data warehouse, the possibilities for competitive advantage and other market gain seem equally endless for those who build one successfully. Some retail companies have achieved a payoff of 10 to 70 times their initial investment of $350,000 to $750,000, notes David Gelardie, manager of commercial markets for IBM's RS/6000 Division (Somers, NY). At the high-priced end of the hardware spectrum, one customer who invested $20 million in a complete system achieved a

50% BRIGHTER. 25% SMALLER.
It's not just active matrix.

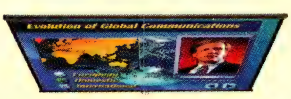
IT'S HYPER
active-matrix.

The In Focus LitePro® 580. The new standard in multimedia projectors.

Hyper. It means above and beyond. And that's our new LitePro 580.

It's the smallest, lightest and brightest multimedia projector. Ever.

The LitePro 580 has built-in video support and stereo speakers. Yet it's about the size of an ordinary slide projector. It's packed with other features, too, like a zoom lens that will fill a 7 meter wall with your image. And a remote control with trackball that operates your PC or Mac like a wireless mouse.



New polysilicon active matrix means you get the highest image quality of any LCD projector.

Plus, it's got the latest polysilicon active matrix LCD. So, together with advanced dichroic optics, it gives you the brightest image (well over 200 lumens reflected off the screen) and the truest, most saturated colours of any LCD projector.

And that means you can deliver outstanding full-motion multimedia presentations and training sessions without having to dim the lights.

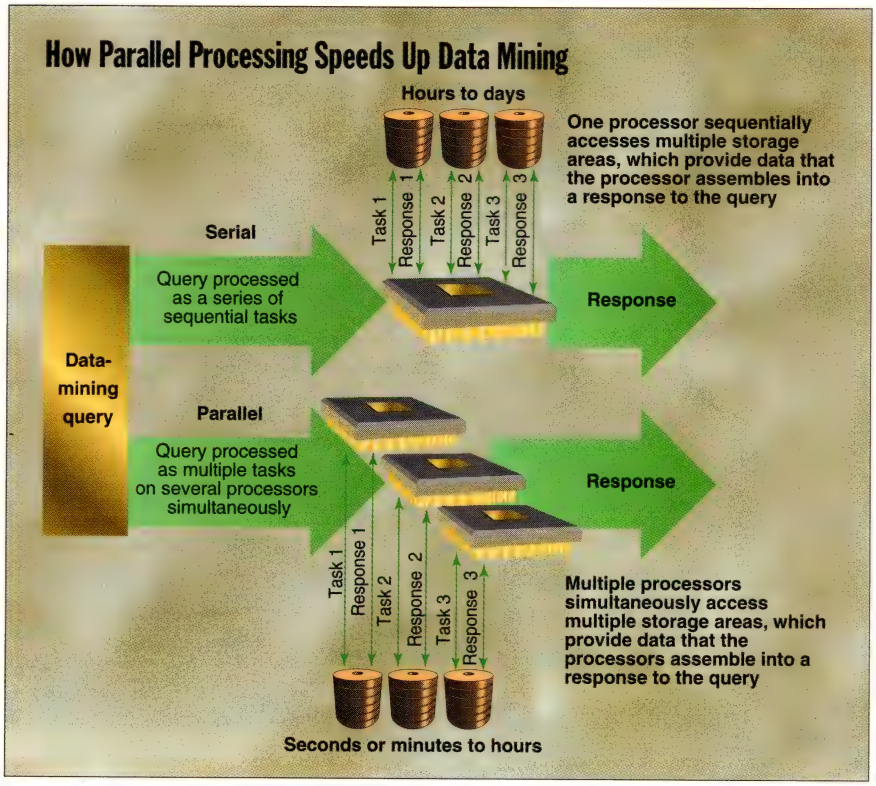
As the leader in LCD projection, we offer a complete line of projectors and panels for any need and budget. Including the new standard – the LitePro 580. Compared to anything else out there, it's hyper.

InFocus®
SYSTEMS
Great ideas. Brought to light.™

Discover electronic presentations. For a test drive or free demo disk call
UK: 0500 262 440 Germany: 0130 813 649 France: 0590 5993 Italy: 1678 77238 Spain: 900 993 163

European Head Office: Planetenweg 91, 2132 HL Hoofddorp, The Netherlands. Tel: +31 2503 23200; Fax: +31 2503 24388.

Circle 549 on Inquiry Card (RESELLERS: 550).



payoff in just four months.

Kastner is not at all surprised by these phenomenal ROI figures. "The first thing you do is skim the cream off the top," he says. "And in this market, there's lots of cream."

The propensity to mine additional profits or a competitive advantage from well-designed warehouses has some advocates talking about the so-called One-Query Theory. Buffum states that "there exists in every shop one query that—if you figure out what it is and implement the knowledge derived from it—will pay for the entire data-warehousing and data-mining system."

Warehouse Sandwich

Parsaye is well known in the data-warehousing field for what's known as his Sandwich Paradigm, a philosophy for building data warehouses that encourages acceptance of the probability that the first iteration of a data-warehousing effort will probably require substantial revision.

Instead of recommending that users buy

hardware and software, build a data warehouse, and then load their data, the Sandwich Paradigm advises that they pre-mine the data to determine what formats and data are needed to support a data-mining application, build a prototype mini–data warehouse (the "meat" of the sandwich) with most of the features anticipated in the final product, revise the strategies as necessary, and finally build a full warehouse. In this way, problems with poor-quality data or ineffective designs can be rectified before thousands or even millions of dollars are wasted. Often users realize that their data structures are ill-designed, or they gain so much experience with the prototype that they realize that a second chance at building the system could add value that would justify the expense.

To support newly cleansed data, experts advocate maintaining a collection of information about the transformation process. This *meta-data* describes the contents of the data warehouse; where the warehoused data originated; and the translations, aggregations, table lookups, and other transformations that occurred in the warehousing process. For many data-warehousing users, this information becomes critical after the migration is completed, when more detail is needed about a particular group of data or when errors in the warehoused data become evident.

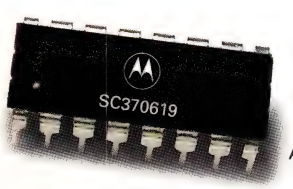
Specific information about successful data-warehousing efforts is sparse, partly because such an effort is complex and extensive, and partly because the companies that succeed are loath to divulge what they perceive as a competitive advantage. It is known, however, that successful data warehouses are usually only half as large as is necessary to support the number of users and applications that quickly become "critical."

When a data warehouse succeeds, more users than initially planned want to employ data mining to their advantage. Data-warehousing and data-mining applications are usually installed with a specific motive in mind, such as fraud detection or profit generation, says Kastner.

But once a data warehouse is installed, the number of users almost always increases with the success of the system. For instance, one department-store chain based in the U.K. implemented a data-mining system to better understand customer-buying trends. Within six months, one of the biggest users of the system was the chain's accounting department, which began tracking profit and loss leaders. Analysts discovered that the shoplifting of batteries, film, and midpriced pens cost the chain $60,000 a month. These products were moved to a more secure store location, saving the chain over $700,000 annually.

One offshoot of the fast-growing data-warehousing and data-mining market is that tool and database vendors are announcing partnerships in record numbers. But "they're not worth the paper they're printed on," warns Kevin Strange, research director for industry analyst the Gartner Group (Stamford, CT). With rare exceptions—such as Platinum Technology (which is creating synergies by acquiring companies such as Trinzic) and Software

POWERED BY MOTOROLA.



COLORLESS. ODORLESS. TASTELESS. THERE WAS DANGER LURKING AS WE SLEPT. THEN FIRST ALERT AWAKENED US TO THE BENEFIT OF A CARBON MONOXIDE DETECTOR. NOW WE CAN REST EASIER, RELYING ON THIS SILENT GUARDIAN — WHICH COUNTS AMONG ITS PARTS A MOTOROLA MANUFACTURED DIGITAL-ANALOG CHIP TO KEEP IT VIGILANT. FROM VIDEO CAMERAS TO HOME SAFETY DEVICES, PRODUCTS POWERED BY MOTOROLA ARE FAST BECOMING A WAY OF LIFE.

FOR INFORMATION CALL 1-800-521-6274.

MOTOROLA
Semiconductor Products Sector

DATA-WAREHOUSE CONSTRUCTION TIPS

- **Accept that your first try will require revision.**
- **Examine your data: What formats and specific data are needed to support your application?**
- **Bite the bullet and clean up your data before using it in the warehouse.**
- **Build a prototype mini–data warehouse as a learning experience and then revise strategies as necessary.**
- **Plan on more users' taking advantage of a successful data warehouse than you initially expected.**
- **Keep storage options in mind: Your data is only going to grow.**

AG (which is creating an initiative among several vendors)—industry partnerships in this market do not benefit customers. But the good news here for buyers is that the efforts made by Software AG and Platinum will force other vendors to create alliances, Strange says, probably by the end of the year.

Parallel Power

Parallel processing speeds up the work of decision-support systems such as data mining by dividing a complex query into multiple parts and assigning each part to a separate processor. The processors work concurrently, unlike serial processors, which address one process after another.

While data mining is unquestionably being driven by the affordability of highly powerful parallel-processing computers, interest in data mining is also driving parallel sales; it's a synergistic effect. Once the province of the scientific community and its deep-pocketed sponsors, parallel-processing machines have dropped in price by 30 percent to 40 percent annually for the past several years, bringing them into the realm of the affordable.

Parallel-processing systems are available in two distinct flavors: symmetric multiprocessing (SMP) and massively parallel processing (MPP). SMP systems share a common memory among clusters of machines. MPP systems are often called "shared nothing" or distributed-memory systems, because each processor has its own memory.

SMP systems are typically used for smaller data warehouses holding 100 GB of data or less, while MPP machines are necessary once a data warehouse hits 500 GB. The gray area in between is something of a battleground among vendors, who argue points of scalability, cost, and performance.

Clustered SMP systems are well suited to applications with *lumpy data*, which is heavily used for data-mining queries. Because the processors are clustered and memory is shared, no one processor is exclusively assigned to access the key data, thus preventing bottlenecks. In contrast, MPP vendors suggest that sites planning for many users or heavy data volumes use

MPP systems rather than clustering multiple SMP systems.

Sales of SMP-based systems are projected to be larger than those of MPP systems for the foreseeable future, predominantly because of their lower cost and better scalability, explains Howard Richmond, a vice president of the Gartner Group. Yet the MPP market is also experiencing significant growth, he adds.

Storage: Not the Final Frontier

The last enabling data-mining technology is storage. Once a no-brainer, data storage is now so important that some sites actually keep their storage devices and data under the protection of armed guards.

With data warehouses storing gigabytes and terabytes of data, and projections calling for warehouses holding hundreds of terabytes within five years, affordable storage technology is key to serious data mining. Disk-storage prices, which had been falling an average of 30 percent to 40 percent annually, are falling even faster so far this year, and storage vendors are running hard to stay even.

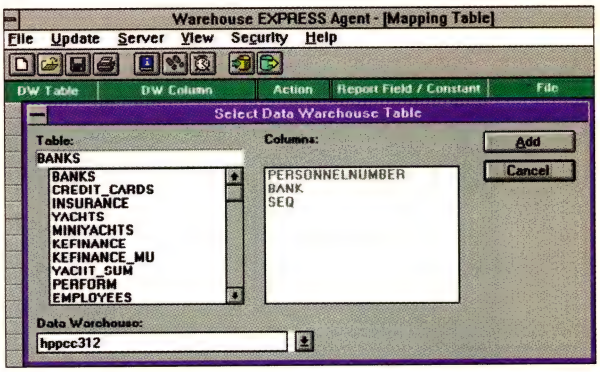
Like processing, storage technologies such as RAID (an acronym for redundant arrays of independent disks) are becoming increasingly parallel. The concern of many industry watchers is the lack of a faster technology for reading data off a storage disk. There are no new storage technologies on the horizon as yet, which could make storage a bottleneck for data-mining applications as queries become more complex, storage volumes increase, and parallel machines get faster.

Pot of Gold

Every business will have a data warehouse in 10 years, predicts Kastner, whether it's the company's custom warehouse or one that's available through wideband networks connected to desktop systems. The benefits of knowing one's business and customers will become so critical that the technology will be positively pervasive, he adds.

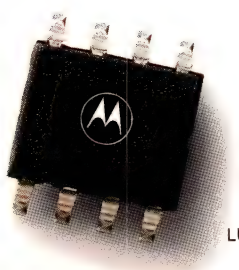
Previously unrelated technologies are coming together to support data mining. That can only make data mining easier. ■

Cheryl D. Krivda is a technical journalist based in Perkasie, Pennsylvania, specializing in information-technology topics. She can be contacted on the Internet at 5309513@mcimail.com or on BIX c/o "editors."



Software AG's SourcePoint Administrator lets a user select a table from the warehouse and map columns to fields from the extract process.

POWERED BY MOTOROLA.



GOOD LOOKING. RELIABLE. BRIGHT. THE TIMEX® INDIGLO® NIGHT-LIGHT BRILLIANTLY ILLUMINATES THE ENTIRE WATCH DIAL AT THE PUSH OF A BUTTON. A SHINING PERFORMANCE SPARKED BY A MOTOROLA ANALOG ELECTRO-LUMINESCENT DRIVER WORKING TIME AFTER TIME AFTER TIME TO BRING TIME KEEPING OUT OF THE DARK AGES. FROM WATCH LIGHTS TO AUTOMOTIVE ELECTRONICS, PRODUCTS POWERED BY MOTOROLA ARE FAST BECOMING A WAY OF LIFE.

FOR INFORMATION CALL 1-800-521-6274.

MOTOROLA
Semiconductor Products Sector

TAKE INFORMATION

FROM THE MINDS OF THE FEW

AND PUT IT INTO THE

MINDS

OF THE MASSES.

CD-ROM changed the way you think about computers. And the AXIS Network CD-ROM Server is going to change the way you think about CD-ROM.

(Pretty bold statement there, but if you're dealing with a network, please read on.) These breakthrough servers hook into your network and allow your users to share information. And each one can handle up to seven drives at any one time.

These RISC-based, multiprotocol servers make network integration trouble-free. (In other words, they support SMB over NetBEUI/NetBIOS, and NFS over TCP/IP, allow Windows and UNIX users to share information, don't need software drivers or file servers, and install anywhere.)

For further information, please call one of our local distributors. Because when it comes to information, sharing the wealth can be a capital idea.

AXIS COMMUNICATIONS

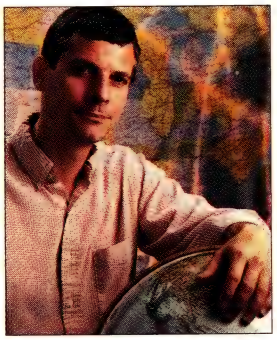
Germany: 064 04 9105-0
UK: 0483-797787
France: (1) 69 07 66 71, (1) 40 10 28 28, (1) 60 13 13 14

e-mail info@axis.se
URL: http://www.axis.se

Circle 525 on Inquiry Card (RESELLERS: 526).

BOMB's Away

JON UDELL



AL KARVEY @1995

Here's how BYTE remade a postcard-based reader survey into a Common Gateway Interface–based Web application

Smuggled onto your PC, in the guise of a multimedia viewer, your World Wide Web browser is actually an all-purpose client that runs applications on a vast global network. Likewise, your Web server, justified to your company's controller as a marketing tool, can act as an applications server that connects you to customers, suppliers, and business partners.

One of the most popular uses of this new client/server model is the on-line survey. If you read BYTE in the 1970s and/or 1980s, you may recall BYTE's Ongoing Monitor Box, more commonly known as the BOMB. It was a page that reported how readers ranked the previous month's articles, together with a postcard that solicited feedback on the current issue.

The BOMB fizzled years ago, and we've missed it. The advent of the BYTE Web site set the stage for a 1990s remake. To try it, surf on into http://www.byte.com and go to any article in our archive. Along with the standard links across the top of each page, you'll find one labeled "Comment." Click on it to invoke a Hypertext Markup Language (HTML) form with multiple-choice questions and space for comments.

Our archive isn't just an electronic publication now; it's also an application. What follows is a look at how we put it together and how you can build one like it.

Step 1: Make the Form Context-Sensitive

The first task was to make the Web BOMB context-sensitive. If you're reading a story on-line and decide to comment on it, the form that pops up when you click on the Comment button will display a title such as "February 1995 / News & Views / Optical Drives." These same three items—the story's issue, section, and title—will also appear in the database record that's created when you submit the form.

Since the archive has 1500 documents, must there also be 1500 forms? Actually, there are none. As is common practice, the Web BOMB relies on a Perl script to print the forms on demand. What activates that Perl script? The Comment link on each of the 1500 pages. So, while I didn't have to write 1500 forms, I did need to write 1500 links that look like this:

```
<a href=/cgi-bin/perl.exe?\
cmt1.pl+9502+News_&_Views+\
Optical_Drives>Comment</a>
```

This code says: "When the Comment link is clicked on, launch the Perl interpreter, feed it the HTML-form-writing Perl script cmt1.pl, and in turn feed cmt1.pl three arguments—the issue, section, and title of the current article."

These links are far more concise than the forms that cmt1.pl generates, but it still wouldn't have been practical to write 1500 of them by hand. But then, I don't write any of the archive's HTML source by hand. An Epsilon Extension Language (EEL) program (see part A of the figure "Anatomy of the Web BOMB" on page 106) does that for me, and one additional `printf` statement was all it took to put a context-sensitive comment link on every page in the archive. Part B of the figure shows the EEL program's output—the HTML source for a page. Part C illustrates how a browser renders that HTML source.

Step 2: Print the Form

When you click on the Comment button, the Web server invokes cmt1.pl and relays its output—an HTML form—back to your browser. The cmt1.pl script begins as shown in part D of the figure. The first line prints the standard Common Gateway Interface (CGI) header. The second line saves the uniform resource locator (URL) of the article that prompted the comment, so the form-processing script (cmt2.pl) can offer the user a link back to the article.

HTTP_REFERER is the charmingly misspelled CGI environment variable that contains the URL of the referring document—in this case, the article on which the Comment link appears. Note how the name HTTP_REFERER keys into the associative array (i.e., the list of name-value pairs) that Perl uses to represent environment variables. Each of the next three lines takes an argument from the Perl command line, saves it in a variable, and turns underscores (which are inserted at the EEL stage to make multiword arguments behave atomically) back into spaces.

The cmt1.pl script then prints the HTML document that your browser renders as the Comment form. It incorporates the issue, section, and title variables into the document's header. Then it begins writing the form as the body of the document. The opening phrase of the HTML form element says: "On completion of this form, launch the Perl interpreter, feed it the form-processing script cmt2.pl, and in turn feed cmt2.pl four arguments. Transmit the data collected on the form to cmt2.pl by way of a file (`method=post`) rather than on the command line (`method=get`)."

The rest of cmt1.pl completes the form. HTML can describe interactive GUI controls, such as check boxes, radio buttons, drop-down listboxes, and single- or multiple-line text boxes. The Web BOMB just uses a series of check boxes for the multiple-choice questions, and a multiline text box for the free comments. The figure shows some of the HTML source that creates the multi-

ANATOMY OF THE WEB BOMB

Common Gateway Interface (CGI) programming involves peculiar flows of control and data. Follow the solid black arrows to trace the flow of control from programs to documents to programs to documents as the Web BOMB works. Follow the red, numbered circles to trace the flow of the three items of data—the article's issue (1), section (2), and title (3)—that make the Web BOMB context-sensitive.

A

Don't even think about publishing a large collection of documents on the Web unless you can automatically generate those documents.

I could have used Perl for this job, but Epsilon's EEL seems even better. I like how EEL supports both declarative and navigational text processing. You can do the same kinds of global regular-expression searching and replacing that Perl can do. But you can also programmatically wield all the navigational and interactive powers of a text editor: searching forward and backward, inserting text, and jumping to locations.

B

HTML, like PostScript, is a language that should mostly be written by programs rather than by humans. Unlike PostScript, though, HTML is easy to write. That makes Web development very convenient.

When you want to use a program-generated form like this one, first write it out by hand and test it in your browser. When it works the way you want, you've got a specification for the document that your program must write.

C

You launch a CGI program by clicking on a link. Here the link is textual—it's the word *Comment*. To create this kind of link, you write HTML source like this:

Comment

Alternatively, you can make the link graphical. To do that, you write HTML source like this:

<img src=cmt.gif>

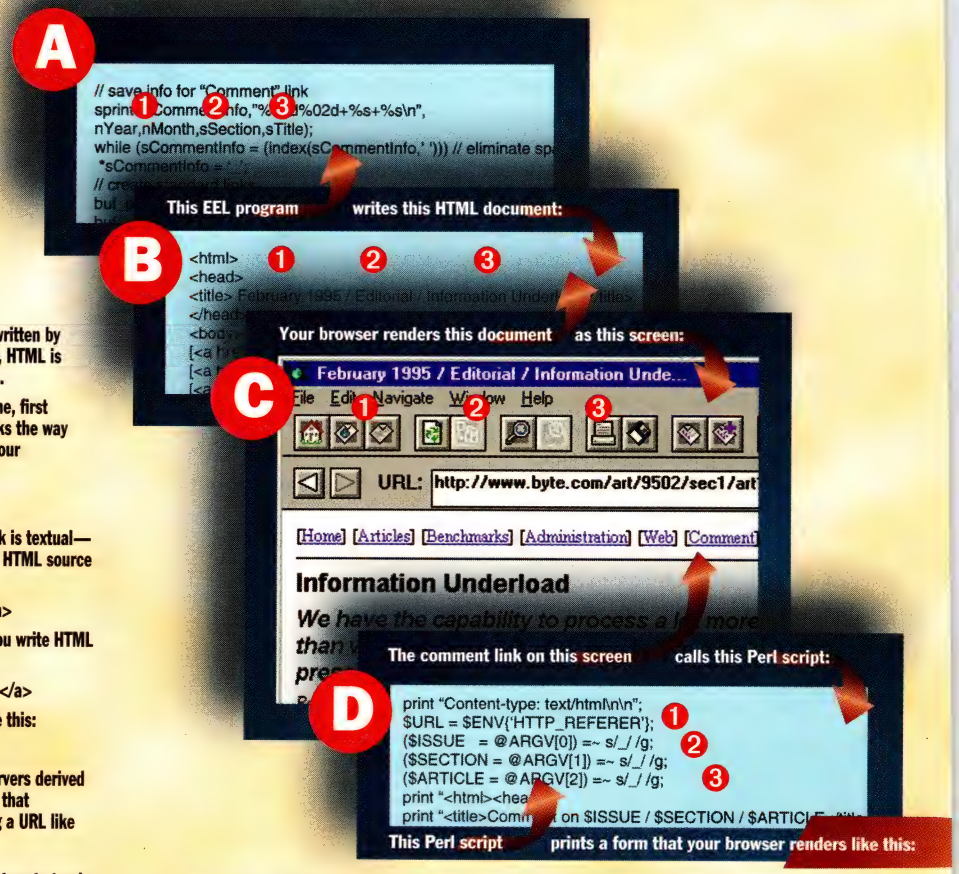
Note: With most Web servers, the CGI link actually looks like this:

<a href=/cgi-bin/cmt2.pl?args>

Invocation of the Perl interpreter is implicit. However, NT servers derived from EMWAC's code require explicit invocation of Perl. Isn't that dangerous, I wondered? What's to keep a user from entering a URL like

http://www.byte.com/cgi-bin/perl.exe?-e+unlink+*.*

using Perl's "enter a line of script on the command line" feature to trash a bunch of files—or worse? Process Software agreed this is a problem, and it will have a fix in Purveyor 1.1.



Web servers communicate a number of environment variables to back-end CGI programs. Here, Perl gets the referring article's URL from the HTTP_REFERER variable. It will be a string like this:

http://www.byte.com/art/9502/sec1/art1.htm

Separately, Perl saves the issue, section, and title information passed to it on the command line.

ple-choice questions (part D) and the resulting form as displayed in a browser (part E). The cmt1.pl script ends this way:

```
print "<input type=submit value=
        Send><input type=Reset>
      </form></body></html>";
```

The input tags specify two buttons. The first submits the form to cmt2.pl for processing, and the second resets the form. The final three tags close the form element, the document's body, and the document.

Step 3: Process the Form

When you fill out the form and click on the Send button, the Web server launches the back-end CGI program named in the form's `action=` statement: cmt2.pl. Its first two lines (see part F of the figure) say: "Include CGI support routines; call one of them, `ReadParse`, to locate the file in which the server placed the completed form's data; and transfer the name-value pairs stored there into a Perl associative array called 'input.'" Using the names of form variables as keys into the array, cmt2.pl then takes the values of the form variables and puts them into Perl variables, as shown in part F of the figure.

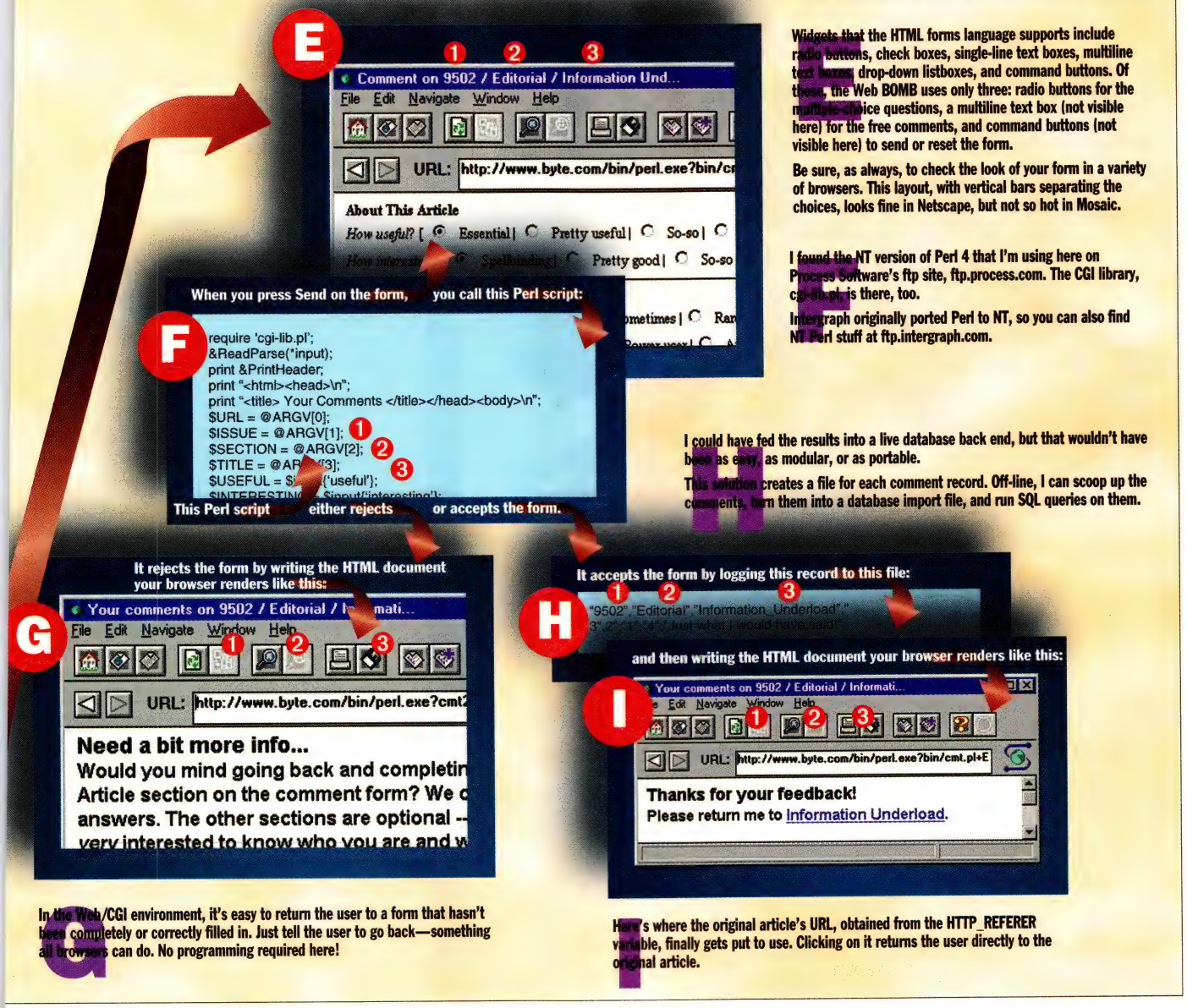
With the form data in hand, cmt2.pl can now rule on whether to accept the form. The Web BOMB presents a form in three parts—questions about the article, questions about the reader, and free comments—but requires only that you complete the first section. If you don't, at least one of that section's form variables will be null. The cmt2.pl script notifies you if that's the case.

How? A conventional GUI program pops up a dialog box, but CGI programs can communicate with users only by way of HTML, so cmt2.pl must format its "need more info" message as an HTML

BOOKNOTE

Build a Web Site, $34.95
by the staff of net.Genesis and Devra Hall
Prima Online Books, 1995
ISBN 0-7615-0064-2

A fat cookbook full of useful recipes. Shows how to acquire and set up the CERN (the European Laboratory for Particle Physics) and National Center for Supercomputing Applications (NCSA) Web servers. Discusses HTML 2.0 and 3.0, teaches basic CGI programming, and offers an advanced tutorial on rolling your own Web clients and servers.



Widgets that the HTML forms language supports include radio buttons, check boxes, single-line text boxes, multiline text boxes, drop-down listboxes, and command buttons. Of these, the Web BOMB uses only three: radio buttons for the multiple-choice questions, a multiline text box (not visible here) for the free comments, and command buttons (not visible here) to send or reset the form.

Be sure, as always, to check the look of your form in a variety of browsers. This layout, with vertical bars separating the choices, looks fine in Netscape, but not so hot in Mosaic.

I found the NT version of Perl 4 that I'm using here on Process Software's ftp site, ftp.process.com. The CGI library, cgi-lib.pl, is there, too.

Intergraph originally ported Perl to NT, so you can also find NT Perl stuff at ftp.intergraph.com.

I could have fed the results into a live database back end, but that wouldn't have been as easy, as modular, or as portable.

This solution creates a file for each comment record. Off-line, I can scoop up the comments, turn them into a database import file, and run SQL queries on them.

In the Web/CGI environment, it's easy to return the user to a form that hasn't been completely or correctly filled in. Just tell the user to go back—something all browsers can do. No programming required here!

Here's where the original article's URL, obtained from the HTTP_REFERER variable, finally gets put to use. Clicking on it returns the user directly to the original article.

TOOLWATCH

Submit It
http://www.cen.uiuc.edu/~banister/submit-it/

Once you've built a Web site, you'll want to publicize it. Where? On Yahoo, Lycos, WebCrawler, and a dozen other well-known sites. You can visit each of these in turn...or you can have Scott Banister's Submit It act as your publicity agent.

document that it relays back to you by way of the server.

How does the Web BOMB redisplay the form so you can complete the required fields? That's easy. The "need more info" document (part G of the figure) tells you to use your browser's "go back" function, which reloads the form. When you complete the form to cmt2.pl's satisfaction, it logs the data (part H) and returns a "thanks for your input" document (part I).

From there, you could unwind the document stack using the "go back" function, but it's more convenient to jump straight to the article that prompted the comment, so cmt2.pl supplies a link to it. This is where the article's URL, which cmt1.pl got from the HTTP_REFERER environment variable and passed to cmt2.pl, finally comes into play.

Step 4: Log the Data

When I first envisioned the Web BOMB, I thought it should pump the survey results into a relational database. This client/server scenario, in which clients connect through HTML forms to relational servers, represents the most compelling (and, to vendors of SQL front-end toolkits, the most frightening) aspect of Web/CGI technology. Since a survey isn't a transactional application, though, implementing the Web BOMB this way seemed like overkill. Users would pay an unnecessary performance penalty, and I'd end up with an application that was more complex and less portable than it had to be.

Instead I opted for a simpler, more modular solution. Rather than inserting a record into a database, cmt2.pl logs data by writing a line of text to a file, as shown in part H of the figure. As my Perl mentor Ben Smith likes to say, "If every record is a file, record locking isn't a problem."

How do you analyze the data? That's easy. Combining all the comment files yields a comma-delimited ASCI import file that FoxPro, dBase, or almost any other database program can read. Then you can answer questions such as "How did

AnthroCarts®!

AnthroCarts will knock your socks off! Imagine how great it'll be when you find the perfect furniture for your equipment — just the right size, tough as nails construction and dozens of accessories.

And you'll find our service so real and responsive, you'll get a kick out of ordering direct!

Call for a free catalog!

Lifetime Warranty.

Adjustable for all sizes.

Lots of choices.

800-325-3841
6:00 AM to 6:00 PM PST, M-F
e-mail: sales@anthro.com

ANTHRO®

10450 SW Manhasset Drive
Tualatin Oregon 97062
Phone: (503)691-2556
Fax: (800)325-0045

GSA contract no. GS-OOF-5040A. Available for OEM applications. Prices from $159.00
Anthro, AnthroCart and Technology Furniture are registered trademarks of Anthro.

the interest in reviews vary by month?" or "What were the top 10 articles?" with straightforward SQL queries.

Next-Generation Client/Server?

Like the thousands of CGI programs on the Internet, the Web BOMB exhibits four desirable properties: *client-server*, because your browser interacts with our server; *cross-platform*, in that Windows, OS/2, Mac, and Unix clients can connect to any of these flavors of servers; *WAN*, since clients connect to servers over the Internet; and *rapid application development (RAD)*, because it's a snap to build.

Web technology isn't just a way to publish electronic documents. It's also a way to build networked applications that work within and across corporate boundaries. But it isn't yet a client/server developer's dream. I realized this when, in parallel with the Perl version of the Web BOMB, I prototyped a Visual Basic version using the nifty Windows CGI that's unique to O'Reilly and Associates' WebSite.

In principle, this sounds great: VB, the preeminent RAD tool, has to be the ultimate enabler for Web development, right? Well, maybe not. It's true, as O'Reilly's documentation says, that VB's a great way to get at data that's available through Windows APIs, such as OLE and Open Database Connectivity (ODBC).

But that's not necessarily a VB exclusive. A Win32 version of Perl, for example, could also wield these strategic APIs. On a level playing field, I'll choose Perl: For the text-processing chores typical of CGI applications, Perl's far more capable than VB.

What makes VB great are its plug-in user-interface (UI) components, such as the data-bound controls that have revolutionized client/server database development. However, Web-aware VB custom controls (VBXes) and OLE custom controls (OCXes) don't exist yet, and even if they did, today's browsers couldn't host them.

Browsers and components will evolve in this direction. Meanwhile, Sun Microsystems' Java/Hot Java technology has the potential to trigger a revolution like the one that VB touched off. Java's a language that describes Web applets; Hot Java's a browser that has the ability to download and run them. One way or another, strategic networked applications will increasingly run on the Web. ■

Jon Udell (judell@bix.com) is BYTE's executive editor for new media.

INTRODUCING **ISDN WITH V.34 IN A SINGLE DEVICE**

THE MODEM OF THE MILLENNIUM

Blazing ISDN speeds up to 128Kbps and analog speeds up to 28.8Kbps. Implement V.42bis on ISDN for even higher performance capability. You get it all in one device with the new ZyXEL digital modem, the Elite 2864I— giving you the best of the digital and analog worlds.

The Elite 2864I is an ISDN device that also works like a modem, automatically switching between digital and analog devices without user intervention, while maintaining the highest possible speed and transmission integrity:

- Supports all popular switches. Rate adaption: ITU-T V.120, V.110 and X.75 SLP
- Two B channels can be bundled for ultra-high 128Kbps or used for two simultaneous connections, e.g., voice and data
- Built-in analog adapter communicates with all analog devices
- V.42bis compression on ISDN achieves higher throughput for greater performance
- Embedded protocol analyzer
- Data encryption (DES)*
- Supports V.34 and is backward-compatible
- DTE serial interface up to 460.8Kbps
- High-speed fax —V.17 (14.4Kbps) send and receive. Supports G3 EIA Class 1, 2 and 2.0
- Parallel port for direct fax printing

Don't settle for less than the unique engineering design of the ZyXEL digital Modem of the Millennium.

Call your ZyXEL dealer or call 800-255-4101.

Circle 123 on Inquiry Card (RESELLERS: 124).

Model	Description (5-year warranty)
Elite 2864I-U	LED, ISDN (U interface)
Elite 2864I-S/T	LED, ISDN (S/T interface)
Elite 2864	LED, 2 wire dial-up/leased line
Elite 2864L	LED, 2 wire dial-up, 2/4 wire leased line

yes It runs with NetWare

yes It runs with UnixWare

ZyXEL

THE MODEM OF THE MILLENNIUM

4920 E. La Palma Avenue, Anaheim, CA 92807 • Telephone: (714) 693-0808 Fax: (714) 693-8811
BBS: (714) 693-0762 • Internet: sales@zyxel.com • URL: http://www.zyxel.com

*ZyXEL does not assume any liability arising out of the application or use of any of the security functions described herein. Neither does it convey any license under its parent rights nor the rights of others.
Specifications are subject to change without notice. All trademarks are the property of their respective owners.

111 reasons why we changed our name and logo.

Business Week
Business Week International
Business Week Online
Business Week Strategic Programs
Schaum
College Publishing
Shepard's/McGraw-Hill
CTB (California Test Bureau)/McGraw-Hill
Glencoe/McGraw-Hill
London House
Macmillan/McGraw-Hill School Division
McGraw-Hill School Systems
SRA (Science Research Associates)/McGraw-Hill
SRA Technology Training
McGraw-Hill Home Interactive Software
McGraw-Hill Continuing Education Center
McGraw-Hill Grupo Iberoamericano
McGraw-Hill Interamericana de España
McGraw-Hill Interamericana de Mexico
McGraw-Hill Health Professions Division
McGraw-Hill Healthcare International
Osborne Books
McGraw-Hill Professional & Reference Books
Tab Books
McGraw-Hill Ryerson Limited Canada
DRI/McGraw-Hill
Standard & Poor's
S&P Equity Investor Services
S&P 500 Index
S&P MidCap 400 Index
S&P SmallCap 600 Index
S&P Municipal One Million Index
S&P MarketScope
S&P Stock Guides
S&P Corporation Records
S&P Stock Reports
S&P Research Reports
S&P Outlook
S&P Trendline
S&P ComStock
S&P Compustat
GLOBAL Vantage
J.J. Kenny Drake
McGraw-Hill Municipal Screen
Kenny S&P Information Services
Blue List
KENNYBASE
KENNYCONNECTS
Standard & Poor's CUSIP Service Bureau
Kenny S&P Evaluation Services
MMS International
MMS FOREX Express
S&P Securities, Inc.
Primis Custom Publishing
Platt's
Standard & Poor's Ratings Services
Corporate Ratings
Financial Institutions Ratings
Public Finance Ratings
International Ratings
Insurance Ratings
Structured Finance Ratings
S&P Publishing Services
CreditWeek
KERO-TV (Bakersfield)
KGTV (San Diego)
KMGH (Denver)
WRTV (Indianapolis)
Architectural Record
Construction News Publishing Network
Engineering News-Record
F.W. Dodge
Dodge Reports
Dodge Bulletins
Dodge DataLine²
Dodge Market Leader
Dodge LeadTime
Sweet's Group
Sweet's Catalog Files
SweetSource
Aviation Week & Space Technology
Aviation Week Group Newsletters
B/CA & A/C Flyer
World Aviation Directory
BYTE
Data Communications
Data Communications International
Datapro Information Services
National Software Testing Laboratories
Northern Business Information
LAN Times
Open Computing
The Physician & Sportsmedicine
Postgraduate Medicine
Hospital Practice
Chemical Engineering
Electrical Power International
Electrical World
Energy & Business Newsletters
Environmental Engineering World
Modern Plastics
Modern Plastics International
Power
Utility Data Institute
Tower Group International
TowerNet
Tower Group International Canada Inc.
UCB Canada Inc.
TransGlobal Logistics
TradeRef
Global Finance

PRESENTING

The **McGraw·Hill** *Companies*

If you're surprised by the extent of the McGraw-Hill brands and companies listed above, then you'll understand why we've included them in our name. The change reflects the breadth of our respected businesses and our growing commitment to the diverse strengths of our people. It also expresses our pride in being a leading information services organization, offering valuable analysis and knowledge to worldwide markets through a broad range of traditional and electronic media. While we will always embrace the McGraw-Hill values of high quality and editorial integrity, our new name serves as a reminder that we are equally dedicated to looking ahead.

Financial Services • Information and Media Services • Educational and Professional Publishing

Make sure your data RAID is fast and secure!

You might not know how valuable your data is until it is no longer available, or even worse, it has been lost forever. If such an event were to occur, it will take valuable man-hours to restore the data, if possible, and cost your business countless dollars.
This is why you should invest in a data secure, high availability system, before it is too late!
SOLIDdiskRAID High Performance Systems leaves no room for error. SOLIDdisk RAID offers a fully redundant fault-tolerant solution, as well as the ability to have your data available continuously. This is accomplished since all of the parts, hard disks, power supplies, controllers, and ventilators, are fully redundant, and can be exchanged during operation in case a defect occurs. The **SOLIDdisk RAID** System is a true hot swap unit. There is no down-time, no tools required, and best of all, no cost to you!
There is only one way to guarantee data security, a **SOLIDdisk RAID** System!

Facts: Transfer rate 20 MB/s (100 MB/s in the future). Up to 80 GB/ unit. Max. 128 MB cache. Single or dual processor cache system.
RAID levels 0, 1, 3 and 5. MTBDL more than 4 Mio. hours (500 years).
Supported computer systems: **SUN SPARC, IBM RS/6000, Novell NetWare, HP 9000/800/900, Apple, SGI, Motorola, DEC-VAX, ALPHA.**

Europe: Tel. ++49-89-31 57 19 60
Fax ++49-89-315 16 94

USA: Tel. 1-800•784•RAID
Internet: http://www. solidinfo.com

Distributors:
USA: DICKENS DATA SYSTEMS • Tel: 1-800-448-6177 • Fax: 1-404-442-7525
AUSTRIA: INFORMATION STORAGE • Tel: ++43-2231-66416-0 • Fax: ++43-2231-66416-6
BENELUX : AVANCE • Tel : ++31-3480-30688 • Fax: ++31-3480-30232

IS INFORMATION STORAGE

BENELUX : AXIO • Tel : ++31-2155-11144 • Fax: ++31-2155-26580
SWITZERLAND: SOLID COMPUTER • Tel: ++41-56-701230 • Fax: ++41-56-713069
CZECH. REP.: SOLID COMPUTER • Tel: ++42-2-436991 • Fax: ++42-2-434621

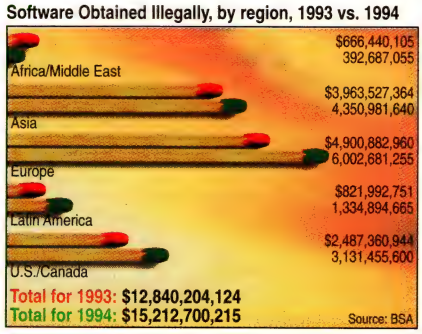
Circle 567 on Inquiry Card.

Software Developers:

Software Piracy Burns Your Profits.

Each year, the illegal use of software consumes nearly 50% of your potential revenues. With the flames of piracy eating away at your profits, can you afford not to protect your software?

Software Obtained Illegally, by region, 1993 vs. 1994



HASP® is widely acclaimed as the world's most advanced software protection solution. Since 1984, thousands of leading developers have used over one million HASP keys to protect billions of dollars worth of software. Why? Because HASP's security, reliability, and ease-of-use led them to a simple conclusion: HASP is the most effective software protection system available.

Today, more developers are choosing HASP than any other software protection method. To learn why, and to see how easily you can increase your revenues, call now to order your HASP Developer's Kit.

1-800-223-4277

1985-1995 YEARS

ALADDIN®

The Professional's Choice

North America — **Aladdin Software Security Inc.**
Tel: (800) 223 4277, 212-564 5678
Fax: 212-564 3377
E-mail: sales@hasp.com
WWW: http://www.hasp.com/

Intl Office — **Aladdin Knowledge Systems Ltd.**
Tel: 972-3-537 5795, Fax: 972-3-537 5796
E-mail: aladdin@aladdin.co.il

United Kingdom — **Aladdin Knowledge Systems UK Ltd.**
Tel: 01753-622266, Fax: 01753-622262

France — **Aladdin France SA**
Tel: 1 40 85 98 85, Fax: 1 41 21 90 56

VISIT OUR WEB SITE!
http://www.hasp.com/

SEE US AT
COMDEX/Fall '95
Booth: S-7422

PC: DOS, Windows, NT, Win 32s, OS/2, Unix, Xenix, AIX, AutoCAD, DOS Extenders, LANs **MAC:** Macintosh, Power Mac, LANs **NEC:** DOS, Windows, NT, LANs **WORKSTATIONS:** Sun, HP, IBM, DEC, SG **AMIGA**

© Aladdin Knowledge Systems Ltd. 1985-1995 (8.95) HASP® is a registered trademark of Aladdin Knowledge Systems Ltd. All other product names are trademarks of their respective manufacrurers. Mac & the Mac OS logo are trademarks of Apple Computer, Inc., used under license

yes It runs with NetWare Developer tested only

Available and Ready for OS/2

MICROSOFT® WINDOWS™ COMPATIBLE

Mac™ OS

■ **Aladdin Benelux** 08894 19777 ■ **Aladdin Japan** 0426 60 7191 ■ **Aladdin Russia** 095 9230588 ■ **Australia** Conlab 3 98985685 ■ **Czech** Atlas 2 766085 ■ **Chile** Micrologica 2 222 1388 ■ **Denmark** Berendsen 39 577300 ■ **Egypt** Zeineldein 2 3604632 ■ **Finland** ID-Systems 0 870 3520 ■ **Germany** CSS 201 278804 ■ **Greece** Unibrain 1 6856320 ■ **India** Solutions 11 2218254 ■ **Italy** Partner Data 2 26147380 ■ **Korea** Dae-A 2 848 4481 ■ **Mexico** SiSoft 5 5439770 ■ **New Zealand** Training 4 5666014 ■ **Poland** Systherm 61 480273 ■ **Portugal** Futurmatica 1 4116269 ■ **Romania** Interactiv 64 153112 ■ **South Africa** D Le Roux 11 886 4704 ■ **Spain** PC Hardware 3 4493193 ■ **Switzerland** Opag 61 7169222 ■ **Taiwan** Teco 2 555 9676 ■ **Turkey** Mikrobeta 312 467 7504

Circle 61 on Inquiry Card (RESELLERS: 62).

Windows 95: The Numbers

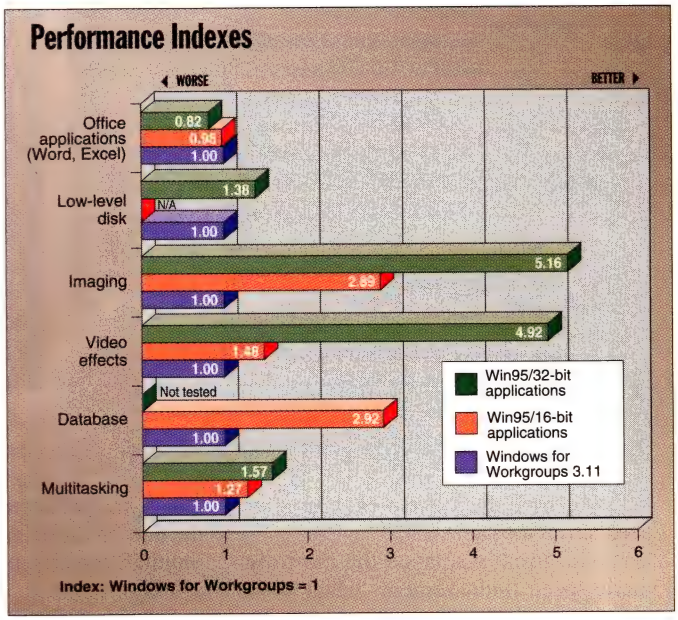
The new Windows architecture delivers enhanced performance, but as BYTE testing reveals, there are strings attached

STANFORD DIEHL

The wait is not yet over for Windows 95. Yes, it has finally shipped, but we still don't have applications that take full advantage of its 32-bit, multithreaded architecture. In extensive testing of the shipping Windows 95 code, we came to a few solid conclusions:

- You won't see a dramatic performance improvement when running your existing 16-bit applications under Windows 95.
- Those 32-bit applications that are not fully optimized for Windows 95 will realize only marginal performance enhancements under the new platform.
- Applications that load large files (e.g., multimedia, imaging, and databases) take full advantage of 32-bit data paths and display the greatest performance gains.
- The Windows 95 environment multitasks applications much more smoothly and with greater stability than Windows for Workgroups 3.11 (WfWG) does.
- Windows 95 requires more memory than previous versions of Windows to run optimally, but for most office applications, the performance gains level off at 16 MB.

The graph of indexed performance (right) charts the big picture. Office applications (i.e., Word and Excel) display no speed enhancement on the new platform, even when tested with the shipping 32-bit applications. The speed improvements stand out on the tests that take advantage of 32-bit data paths.



Required RAM

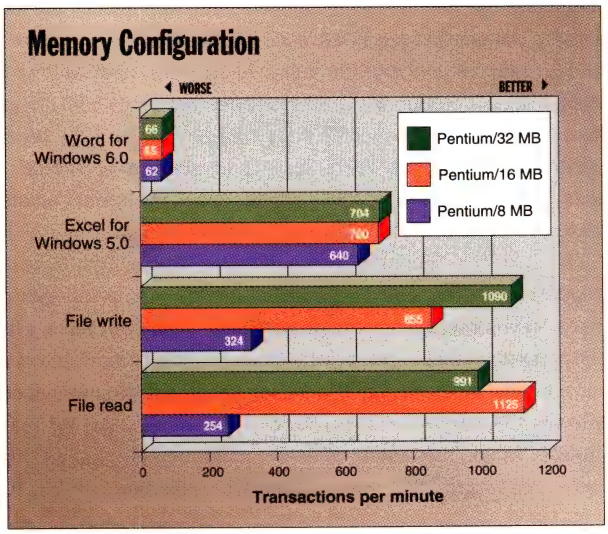
Don't even try to deploy Windows 95 on systems that pack less than 8 MB of RAM. And if you can afford the upgrade to 16 MB, you will appreciate the improved performance.

Of course, if your applications require a large memory footprint, then 16 MB of RAM may not hack it; but for most office applications, 16 MB is sufficient. Upgrading beyond that level won't buy you much additional speed. For testing memory configurations, NSTL used a Digital Equipment Celebris SL 590 (a 90-MHz Pentium); all other tests in this report were run at BYTE on a Gateway 2000 486DX2/66 with 16 MB of RAM.

32 Bits Is Not Enough

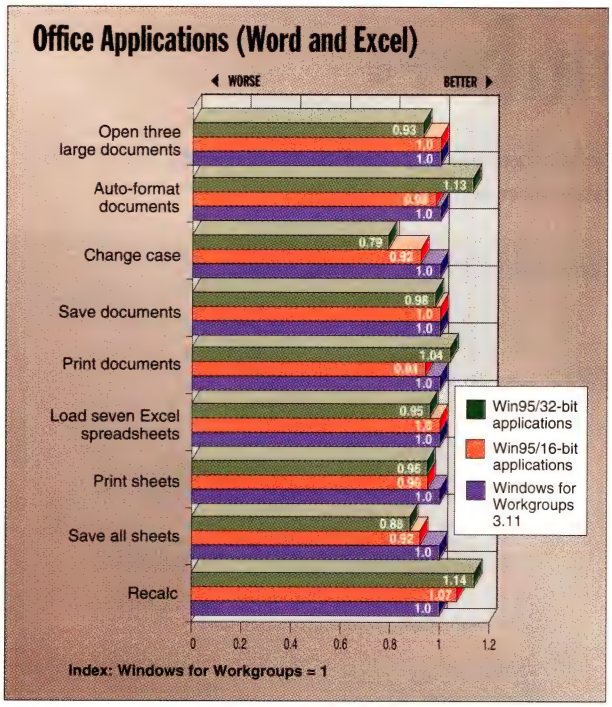
The performance of 32-bit Office 95 applications is disappointing, but this is not the best indicator of overall Windows 95 performance enhancements. Once Microsoft turns its attention to 32-bit optimization for its suite, the performance numbers should improve. "Microsoft has optimized the Office applications like crazy for the 16-bit architecture of Windows 3.1," Andrew Hudson points out. He is president of North Coast Software, an imaging company that develops extensively for Windows 3.1, Windows 95, and multiple NT platforms, including PowerPC. "They just haven't had the time to do the same optimizations for Windows 95," he adds.

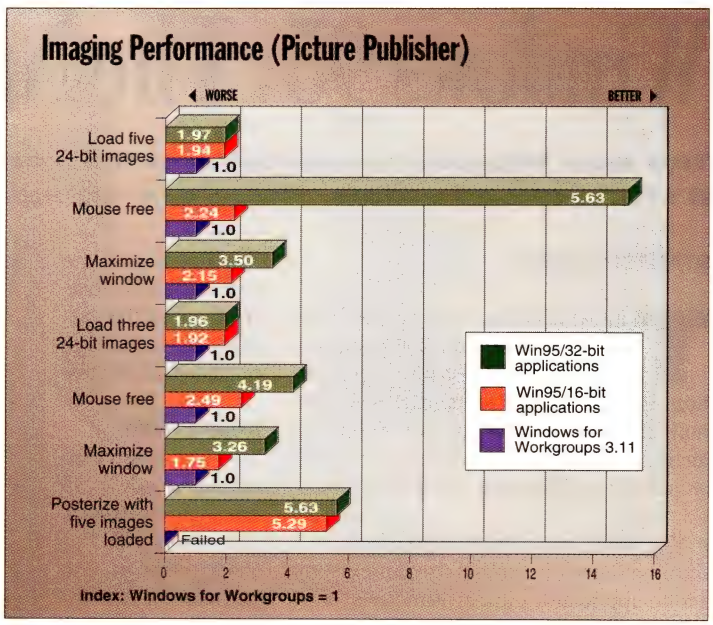
Even with the current Office 95 release, you should notice snappier operation because of improved multitasking and features such as on-the-fly spell-checking and threaded print services. In future Office releases, Microsoft plans to move additional processes into independent threads. These enhancements, along with aggressive optimization, are the kinds of improvements that applications vendors will have to make to boost performance. The OS alone won't do the trick.



Imaging and Multimedia

The most striking performance gains of Windows 95 came in our imaging and multimedia tests. Picture Publisher 6.0 not only supports 32-bit data paths but also spawns threads for each image loaded, letting you resume work more quickly. When we loaded five 24-bit images with Picture Publisher 6.0, the mouse was free after just 8 seconds, giving us control of the system to multitask. Under the same scenario using WfWG and Picture Publisher 5.0, we didn't get mouse control for over 2 minutes. In another show of stability, Windows 95 had no trouble running the posterize test with the five images loaded, but





WfWG froze the system each time we tried to run the same test.

PhotoMorph displayed the most dramatic speed improvements when it was upgraded to the Windows 95 version. The video-effects creation tool uses extensive 32-bit moves and floating-point calculations (an area Microsoft reportedly focused on in Windows 95 after the Pentium bug was revealed).

Multitasking: The Big Win

Anyone who has ever experienced an "application is not responding" crash under Windows will appreciate the improved multitasking of Windows 95. Our multitasking tests show only a marginal improvement in the speed of multiple applications running under Windows 95; but the new environment, with its preemptive multitasking architecture, is clearly more stable.

For our first multitasking suite, we loaded three Word documents, seven linked Excel spreadsheets, and three 24-bit images. We formatted one of the Word documents and saved it while recalculating the linked spreadsheets. WfWG froze each time we ran the suite, crashing one of the three loaded applications in each case. We reran the test with two images loaded (instead of three) and still could not complete the test under WfWG. WfWG finally ran the suite with a single 24-bit image loaded; the timings are recorded as suite 2.

For suite 3, we copied approximately 20 MB of files from a double-speed CD-ROM drive to the hard disk while compiling a video effect with PhotoMorph 2. Suite 4 included loading a document into Word and recalculating our linked Excel spreadsheets while building a 7-MB archive with WinZip.

Under both testing environments, we left 80 MB of disk space free and defragmented the disk before launching a multitasking test. We created the largest permanent swap file that WfWG would allow and kept the default settings of Windows 95 to enable the new dynamic cache (see the Technology Focus box "The Installable File System" below). In all cases, we ran the WfWG tests and the Windows

TECHNOLOGY FOCUS

The Installable File System

A key architectural component of Windows 95 is its layered installable file system (IFS). Under MS-DOS and Windows 3.1, applications and system components that needed to handle file I/O requests had to hook into INT 21h to examine and evaluate those requests. Windows 95 supports file-system drivers as ring 0 components, instead of as real-mode MS-DOS drivers. In addition to the performance and reliability advantages of a 32-bit protected-mode architecture, the IFS can support multiple network redirectors for simultaneous access to different networks. Windows 3.1 could support no more than two network redirectors at a time.

The IFS supports the 32-bit virtual file allocation table (VFAT) driver, the 32-bit CD-ROM file system (CDFS) driver, and integrated 32-bit network redirectors for Windows NT and NetWare servers. With an IFS, third-party vendors can add file systems under the IFS Manager—for example, to support other network OSes (NOSes).

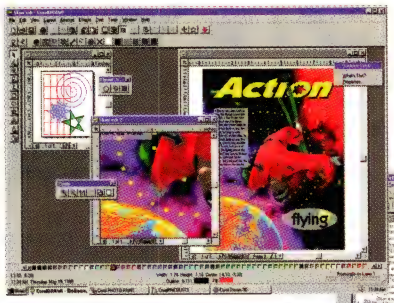
Applications and system components can now access the hard disk file system through VFAT, a 32-bit protected-mode driver that is reentrant and multithreaded. In addition, the Windows 95 block I/O system supports a 32-bit, protected-mode port driver for communicating to specific drive controllers. For SCSI devices, Windows 95 integrates a SCSI layer to handle high-level SCSI calls. The combination of VFAT and the block I/O system opens a protected-mode 32-bit code path to hard disk files.

The VFAT also supports the new caching architecture of Windows 95. VCACHE, a 32-bit protected-mode cache driver that replaces real-mode SmartDrive, dynamically allocates memory for disk caching. CDFS replaces real-mode MSCDEX and requires no conventional memory. The CDFS cache shares its memory pool with the VFAT driver and, like VCACHE, is dynamic. During heavy CD-ROM usage, the system allocates more memory to the CDFS cache and returns the memory when an application requires it.

CorelDRAW 6 is here!!!

With awesome speed, power and accuracy plus hundreds of enhancements, CorelDRAW 6 reaches a new level of graphics productivity. CorelDRAW 6 offers fully-featured software applications for illustration, photo-editing and bitmap creation, business and multimedia presentations and 3D rendering. Plus nine great utilities and incredible libraries.

***CorelDRAW 6** - Multiple Document Interface, increased speed and power*



***Corel PRESENTS 6** - CorelMOVE, CorelCHART and CorelSHOW integrated into one professional presentation module*

***CorelDREAM 3D 6** - Powerful 3D software with easy-to-use CorelDRAW interface*

***Corel PHOTO-PAINT 6** - More speed, unlimited file size support*

Includes

- CorelDRAW 6
- Corel PHOTO-PAINT 6
- Corel PRESENTS 6
- CorelDREAM 3D 6

Plus

- 25,000 clipart images and symbols
- 1,000 photos
- 1,000 TrueType® and Type 1 fonts
- Over 500 3D models

KUR-0114

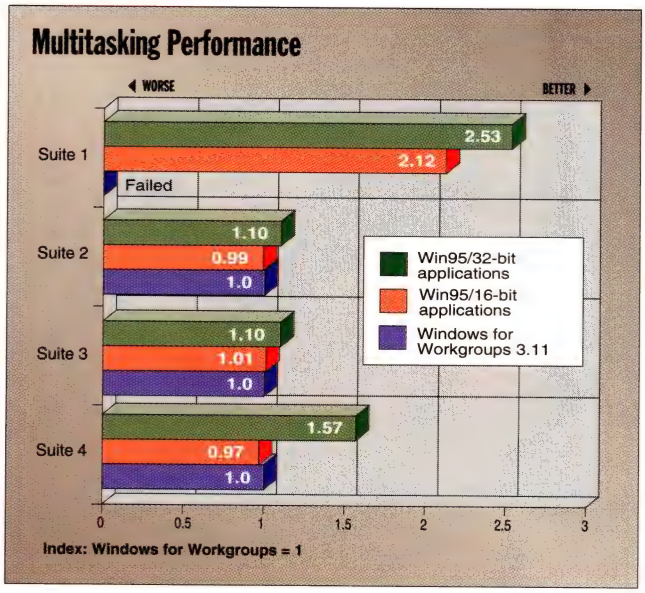
Microsoft Windows®95
Microsoft is a registered trademark of Microsoft Corporation.

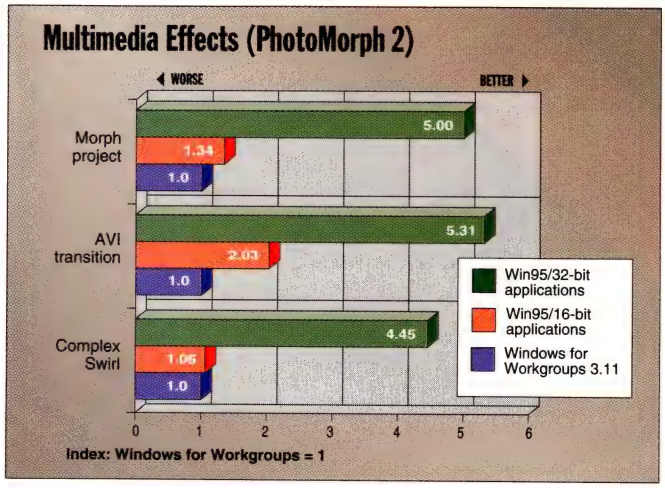
TigerDirect
1-800-CD-TIGER
1-800-238-4437

CorelDRAW 6
$479.90*
CD-ROM Version
CorelDRAW 5 to CorelDRAW 6 upgrade $249.90*
*US$ plus applicable taxes.

COREL®
custserv@corel.ca
Call now for faxed literature!
1-613-728-0826 ext. 3080
Document #1082

Circle 69 on Inquiry Card.





95/16-bit tests with shipping 16-bit applications. The Windows 95/32-bit multitasking suites were run entirely with 32-bit applications (i.e., gold code of Word and Excel for Windows 95; beta code of PhotoMorph 2, Picture Publisher 6.0, and WinZip32).

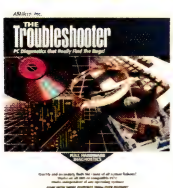
If You Build It, They Will Come

With the right memory configuration and optimized applications, Windows 95 looks like a clear performance winner over Windows 3.1. The bigger win is stability, which has long been a sore point for all of us who do serious work with Windows. As developers start optimizing 32-bit code for Windows 95 and supporting multithreaded processes, the performance will only get better. ■

Stanford Diehl is the director of BYTE product reviews. He has been testing and evaluating computer software and hardware for over 10 years. Before coming to BYTE, he developed computer-based training and database applications for a large industrial contractor. You can reach him on the Internet or BIX at sdiehl@bix.com.

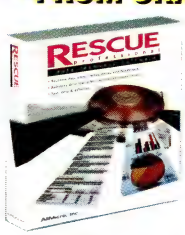
Fix Any PC....FAST!

PC DIAGNOSTICS THAT REALLY FINDS THE BUGS!



The Troubleshooter™ is the most advanced PC diagnostic software available that really finds the bugs. The Troubleshooter bypasses DOS & tests all major hardware components directly for true accuracy. Works with Windows, Windows NT, Windows 95, Novell, MS DOS, OS2, etc. — fully O/S independent. Loaded with all the tests you'll need to accurately isolate the source of PC failures. Priced far below all competitors. Call now for full list of latest features! *New Upgraded Version!*

GET DATA BACK FROM CRASHED DRIVES!



RESCUE Data Recovery Software™ is the only program to easily recover lost data from crashed floppies & hard drives even when DOS can't read them! RESCUE recovers data other recovery programs cannot. RESCUE automatically recovers DOS & Windows files including data from compressed drives. Be prepared for any problem. RESCUE is the insurance and security you need to safeguard your valuable data. Call now! Don't wait until your data is lost!

RESOLVE ANY IRQ OR DMA CONFLICT...100%

The Discovery Card™ is the first tool to accurately resolve any IRQ or DMA conflict. 18 L.E.D. lights (11 for all interrupts and 7 for all DMA) immediately report actual usage thus saving time when configuring, upgrading or debugging PC's. Software alone cannot detect DMA usage and is often wrong when reporting IRQ conflicts! Call now, save time and end the frustration! *Winner 1995 Top Diagnostic Tool - Windows Magazine*

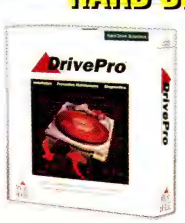
WINDOWS 1995 WIN 100

#1 WINDOWS TROUBLESHOOTING TOOL!

Skylight™ is the #1 rated Windows diagnostic (PC Magazine) that tunes optimizes & troubleshoots Windows for maximum speed and performance. Edits all .INI files safely. Graphically displays how Windows is using memory, system resources, system metrics, G.D.I. heap usage plus much more with hundreds of reports! A must for all Windows users! Call now for full list of features!

PC MAGAZINE EDITORS' CHOICE

FIX OR INSTALL ANY HARD DRIVE...FAST!



DrivePro™ provides fast, precise installation and maintenance for any hard drive. Override BIOS limitations for user-definable drive types. DOS format any size hard drive in under 30 seconds. IDE drives can be installed in less than 60 seconds. Allows the use of IDE drives with MFM/RLL or ESDI drives in the same system. Retrieves the manufacturers' recommended specs from the drive itself, plus much more! Call now for full list of features!

Free Technical Support
Next Day Shipping
Performance Guaranteed

(800) 653-4933 BM

MasterCard VISA AMERICAN EXPRESS

International: (813) 539-7283 • Fax: (813) 531-0200
BBS#: 813-535-9042 • Internet: ALLMICRO@IX.NETCOM.COM

AllMicro,Inc.
18820 U.S. Hwy 19 N, #215, Clearwater, FL 34624

© 1995 AllMicro,Inc. Fix Any PC Fast, Rescue Data Recovery Software, The Discovery Card, and The Troubleshooter are trademarks of AllMicro,Inc. All Rights Reserved. Other names are trademarks of their associated owners. Specifications subject to change without notice.

Circle 122 on Inquiry Card.

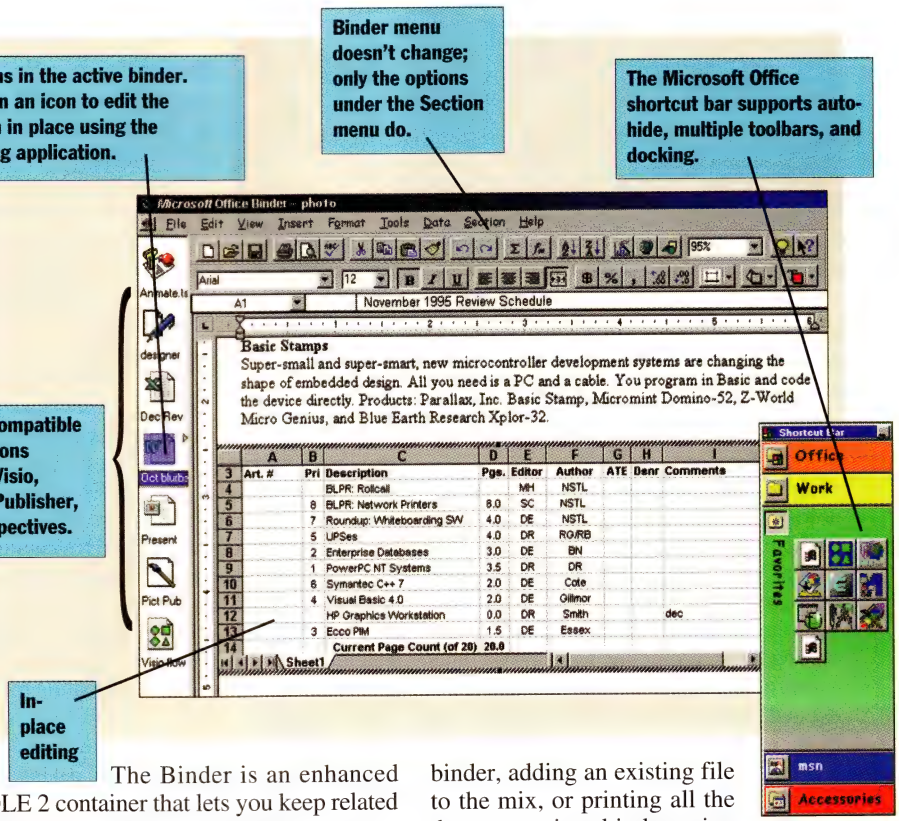
Applications 95 Arrive

Hot new programs that make Win95 worth the upgrade

STANFORD DIEHL

It was classic. At last June's Reviewers Workshop in Seattle, the Microsoft spin doctors downplayed the hype (that they had helped fuel over the last two years or so) surrounding Windows 95 and tried to lower expectations. It's just an OS, the line went, "not a cure for cancer." They are right, of course: It is just an OS, and—as IBM learned—no OS can thrive in a vacuum.

Only powerful productivity applications can infuse a new platform with value. And Windows 95 has the applications to bring it all together. By the traditional definition of a killer app—high-profile productivity software that drives the acceptance of a new technology or system—the beta applications covered here can rightly claim killer-app status. This new software taps into the unique features of Win95 and performs tricks that weren't possible under Windows 3.1.



Microsoft Office for Windows 95

The updated Microsoft Office suite delivers all the basic applications you'll need to become immediately productive in your new operating environment. The applications not only conform to Windows 95—32-bit architecture, multithreading (printing in Word, queries in Microsoft Access), consistent Win95 interface across all applications, long filenames, cross-application drag-and-drop, shortcuts (including creating shortcuts to a specific page in a Word document or a worksheet in Excel), and Briefcase support—but they also include new features worthy of version-number upgrades.

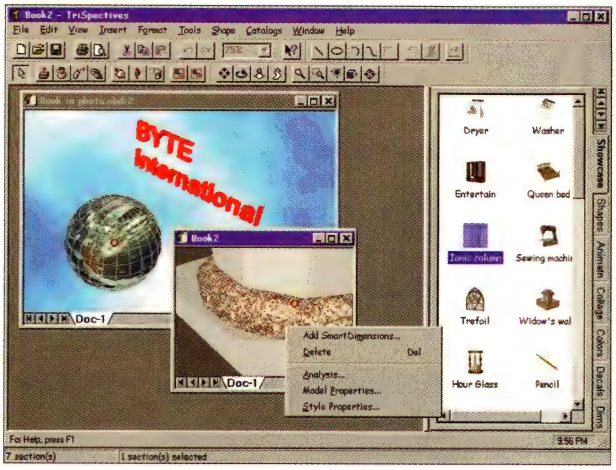
The most striking enhancement to the suite is the new Microsoft Office Binder. The Binder is an enhanced OLE 2 container that lets you keep related documents within a single file structure. You can organize a project's electronic files within a binder, much as you would organize paper within a three-ring binder. Each section of the binder can contain a different file type (a Word document, a PowerPoint presentation, or any other file format that is Binder—not just OLE 2—compatible). You can then reorganize the sections by dragging the section icons (see the screen), dragging a section into another binder, adding an existing file to the mix, or printing all the documents in a binder using consecutive page numbering. Application vendors are already joining the Binder bandwagon, including Visio, Micrografx, and 3D/EYE.

If you already use Office, there is no learning curve, accept when dabbling in new features like the Binder. Given the remarkable market penetration of Microsoft Office, the jump it now has on the competition in supporting Win95, and third-party Binder support, Office 95 is clearly the suite to beat.

Visual Voice for Win32 enables more robust telephony applications under Windows 95, thanks to an integrated TAPI interface, multithreading, support for more telephone lines, and unimodem drivers.

32-bit OLE Custom Controls

Microsoft's promise of an open, standard interface for reusable object components will finally blossom under Windows 95. Microsoft has announced that all its development tools will support 32-bit OLE controls across Windows 95 and NT, and it's worked hard to ensure a healthy component market with such incentives as Custom Control Wizards and extensive developer support. Soon an explosion of OLE controls is sure to hit the market, delivering reusable components for telephony,



TriSpectives Professional offers easy-to-use, sophisticated features. From the tabbed catalog on the right of the screen, you can drag objects onto either 3-D scene on the left. Right-click on an object to bring up tabbed dialog boxes for model properties and style properties.

imaging, communications, and other add-on functionality.

Long at the forefront of component technology, Stylus Innovation has announced its 32-bit OLE implementation of Visual Voice. Visual Voice for Win32 provides the developer with interfaces for recording and playing voice files, sending and receiving faxes, prompting for dial-pad input and processing the touch tones, answering and placing calls, and integrating with PBXes and multiline telephony boards. Visual Voice enables a wide variety of telephony-based applications, including fax-on-demand, Interactive Voice Response, and multilayered voice mail.

Windows 95 will greatly extend the capabilities of Visual Voice applications. The new OS will ship with native TAPI support, unimodem drivers, and multithreaded telephony services.

TriSpectives Professional

If you're looking for brand new software that deserves the killer-app label, check out TriSpectives Professional. It combines 3-D modeling, 3-D illustration, and 3-D animation with the drag-and-drop template model of Visio. TriSpectives implements OLE 2 from the ground up, is fully compatible with the Microsoft Office Binder, and relies on the improved performance of the Windows 95 graphics architecture.

You start with a 3-D scene (or a 3-D page) and a multitabbed catalog (see the screen above). You can select objects from any of the catalogs and drop them onto the scene. You can then drop colors or surfaces onto the object or rotate the object freely in 3-D space. Right-click on the object, and you get a tabbed dialog box for changing the object's properties: Give it a shinier finish, reflect a bit-map image off it, or add a decal of your choosing. Once you've created a model, you can drag and drop animation effects onto it (e.g., Y-move, Z-move, Fly In, or Grow) and access motion properties with a right-click.

The TriSpectives workspace acts as an OLE 2 container, and all the catalog items are independent OLE 2 objects. You can drag OLE objects—such as an Excel chart—from other applications and drop them into a 3-D scene or into a TriSpectives catalog. Once you've devised your own models, you can drag them into a catalog for future use or export them to other modeling formats (including exporting them as Visual Basic text files to generate code for creating models in Visual Basic).

Feature for feature, TriSpectives stacks up well against some high-end 3-D packages like 3D Studio, but its broader appeal stems from the ease-of-use features. It may help move 3-D illustration into the mainstream, enabling nonengineers to incorporate 3-D logos and animation effects into business presentations or product brochures.

ABC Graphics Suite

Micrografx is the latest software vendor to become possessed by value-bundle mania. The company is packaging Micrografx Designer, ABC FlowCharter, Picture Publisher, and a new media-manager utility as an integrated suite and marketing it as an ideal companion product for Microsoft Office. The applications now conform to the Office 95 interface (as with all the Office 95 applications, only the application-specific menu item is unique), and all but FlowCharter are compatible with the Office Binder.

The applications are all 32-bit, and they fully support the Windows 95 interface. The Media Manager is an OLE 2 container for holding libraries of clip-art images and symbols. In fact, ABC FlowCharter uses the Media Manager as its symbol palette. You drag symbols from the palette and drop them into your flow charts, just as you can drop Media Manager clips into any OLE-compatible application. You can also drag any image (e.g., the company logo or a bit-map signature file) onto the Media Manager for use in other applications. The Media Manager supports a wide variety of formats, and it imports and exports them on the fly.

ABC FlowCharter now includes SnapGraphics, a template-based utility for building such business diagrams as time lines, pyramids, and target charts. Drop a diagram into Word or PowerPoint and edit it in place. FlowCharter incorporates OLE 2 automation, so you can build custom applications or use FlowCharter objects in any application that supports Visual Basic.

Of all the new applications we've seen so far, Picture Publisher has the best Windows 95 implementation of multithreading. Time-intensive processes like loading files or applying special-effect filters get

The ABC Graphics Suite includes Micrografx Designer, ABC FlowCharter, Picture Publisher (above), and the new Media Manager (right, sitting on top of a PowerPoint presentation). From the Media Manager, you can drop objects onto any OLE-compatible application or drag new objects into the Media Manager palette. It's a great way to manage clip art, logos, or other reusable objects. Picture Publisher's Image Task Manager tracks the progress of active threads, such as file loads or complex special-effect filters.

TED.™ It's Windows for UNIX.®

One graphical interface for every PC platform. That's the power and simplicity of Windows. And now we're bringing the same concept to the UNIX world with TriTeal's Enterprise Desktop™ (TED 4.0). By providing a Common Desktop Environment (CDE) for every UNIX platform, TED combines all the popular appeal of an industry-standard GUI with all the unbridled power of your favorite UNIX platforms, including Solaris, SunOS, IBM, AIX, HP-UX, UnixWare, Digital UNIX, MP-RAS, SINIX, IRIX, and X terminals. (And yes, it even does Microsoft Windows®)

The result? A base of solidarity for UNIX users everywhere. And a feature-packed desktop with a world of built-in functionality, including fax, e-mail, network access, Internet browser, bulletproof security and more. In short, it's the only CDE product that truly does it all: Every kind of platform. Every kind of application.

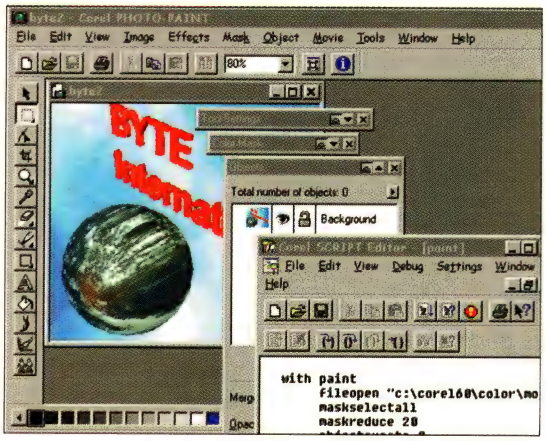
TED 4.0. It's not just a common desktop. It's a whole new window of opportunity. Call us at **1-800-TRITEAL** for a free evaluation copy and white paper.

TriTeal

TriTeal Corporation • Phone (619) 930-2077
e.mail: info@triteal.com • World Wide Web: http://www.triteal.com/

TriTeal Enterprise Desktop and TED are trademarks of TriTeal Corporation. UNIX is a registered trademark in the US and other countries, licensed exclusively through X/Open Co. Ltd. All other trademarks are the property of their respective owners.

Circle 137 on Inquiry Card (RESELLERS: 138).



CorelDraw 6 includes four integrated applications, nine utilities, and a boatload of Corel extras. Shown is Photo-Paint with its roll-up dialog boxes and object palette for tracking objects in the active image. CorelScript is an OLE automation script editor and debugger.

their own thread. The Image Task Manager (see the screen on page 118) tracks the progress of each thread as you go about your work. The architecture showed up first in Picture Publisher for NT but could not be deployed under Windows 3.1. With elegant floating (and dockable) toolbars and intelligent interface design, Picture Publisher and Micrografx Designer meld smoothly into an Office 95 environment.

CorelDraw 6

Corel has always been the Swiss Army knife for Windows-based graphics design. Corel 6 bundles four integrated applications—CorelDraw, Corel Photo-Paint, Corel Presents, and CorelDream 3D (Corel has pulled Ventura from the bundle and will release a new version of the desktop publisher in November). All of the applications sport a 32-bit multithreaded architecture and conform fully to the Win95 interface: long filenames, uninstall modules, wizards, extensive right-mouse-button shortcuts, tabbed dialogs and property sheets, dockable toolbars, and rich OLE 2 functionality (in-place editing, drag-and-drop across applications, and OLE automation through CorelScript). The Corel suite goes a step further, enhancing the interface with dialog roll-ups, an excellent desktop-saving feature (see the screen above).

As always, the package includes utilities (a 3-D logo creator, a multimedia file manager, font management, an OLE 2 scripting language, a dialog editor, and four other utilities) and a gaggle of extras (e.g., 25,000 clip-art images, over 1000 fonts, photos, templates, 3-D models, sounds, objects, animation actors, and backgrounds). Windows 95 may solve one common complaint about Corel: its nonstandard interface. The bundle finally comes together nicely, delivering an integrated solution to Windows-based designers and illustrators.

The Gaming Platform

No bones about it: Microsoft wants Windows 95 to be a killer games platform. As a gaming environment, Windows 3.1 was a big, fat flop. Hard-core PC gamers are still firmly planted in DOS. But the Windows 95 architecture will change all that. Early betas of new games clearly portend a thriving Win95 games market.

Pitfall: The Mayan Adventure (below, right), is an arcade-style adventure game from Activision that has been hugely popular on Nintendo and other gaming systems. Pitfall now works like a charm under Windows 95. It is exactly the kind of game that once required DOS to run effectively. There's lots of fast motion, real-time interactive responses, and intensive graphics. Under Windows' old Graphical Device Interface (GDI) architecture, this level of responsiveness was not possible, but the Win95 DIBEngine lets game developers blast device-independent bit maps (DIBs) directly to the screen. Confirming its faith in the Win95 game market, Activision plans to release eight Windows 95 games by the end of the year and will no longer develop for the MS-DOS platform.

As a gaming environment, Windows 3.1 was a big, fat flop.

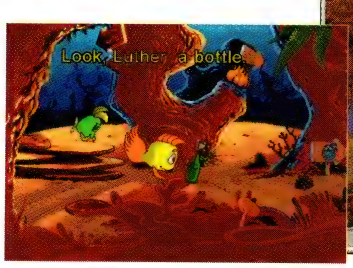
Educational titles should also prosper. The Freddi Fish title (shown below, left) uses auto-run (a Win95 feature that automatically plays a CD-ROM when it is loaded) to avoid installation hassles altogether. You load the CD, and a splash screen pops up automatically. Click on the play button, and the game starts. With auto-run, Freddi Fish implements a "zero-footprint" design, moving files to the hard disk as needed and then removing them when the game exits. The graphics are sharp and colorful, the animation smooth.

An impending upgrade to Display Control Interface (DCI) will further enhance Win95 as a gaming platform, adding automatic support for multiuser games, MIDI sound, and digital joysticks.

Windows 95 Componentware

Componentware—small applets that deliver focused functionality to desktop applications—has been a hot topic, and an expected trend, for some time now. And yet fatware continues to thrive. Again, the clunky mechanism of OLE 1 and DDE under Windows 3.1 must assume part of the blame. Now, with its full integration of OLE 2 and OLE Automation, Windows 95 delivers an environment that will support robust component utilities. Some early announcements prove the viability of component technology; it's now up to the market to determine the success of the componentware design philosophy.

Alphablox, a new company derived from Alpha Software, is shipping a set of five utilities, called Officeblox, that adhere to the componentware model. With Noteblox, you can post sticky notes onto



The new DIBEngine graphics architecture in Windows 95 should spurn a thriving games market that has long eluded Windows. Game developers can now bypass GDI and blast device-independent bit maps directly to screen. This architecture enables fast-paced arcade-style games like Pitfall (far right) and educational titles like Freddi Fish (right) to run smoothly under Windows 95.

[At last. Connectivity without the cord.]

Stop hunting for phone jacks! Make your laptop really portable with the Personal Messenger™ 100 Wireless Modem Card from Motorola. With this compact, easy-to-use card, you can send/receive E-mail from your office network or the Internet, send faxes, or access corporate databases, and more— free of phone lines. With the modem card and Motorola's AirMobile™ wireless software, laptop users with **Lotus® cc:Mail™ Mobile** for Windows® can directly access their corporate E-mail server to exchange messages and files over the ARDIS℠ nationwide wireless data network. It's a single mailbox solution to support mobile workforces, traveling executives and others who want to keep in contact from just about anywhere.* And, using the ARDIS network, there are no roaming or long-distance charges. To untether your laptop from phone lines forever, call for your nearest dealer and an information kit. And, for a limited time, take advantage of a special introductory rebate offer. Call our toll-free number for details.

$100 Motorola Rebate on purchase of the Personal Messenger™ 100 modem card.

Personal Messenger™ 100

Wireless Modem Card slips into most laptops, palmtops or PDAs with a Type II or III PCMCIA slot. This all-in-one peripheral features a built-in battery for stand alone operation, 8K message memory and fold-away antenna.

1-800-8-wireless
1-800-8-947353

No Wires. No Limits.™

Ideal for Lotus® cc:Mail™ Mobile users.
Lotus

ARDIS

MOTOROLA

*The Personal Messenger™ modem card operates on the ARDIS nationwide, two-way wireless data network that covers over 90% of the U.S. business centers.

Ⓜ and Motorola are registered trademarks and Personal Messenger is a trademark of Motorola, Inc. All other trademarks are the property of their respective owners. © 1995 Motorola, Inc. All rights reserved.

Circle 82 on Inquiry Card.

TECHNOLOGY FOCUS

OLE Structured Storage

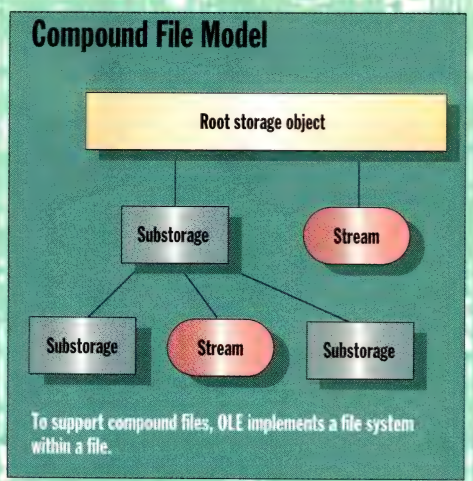
The OLE 2 architecture and, specifically, OLE's Structured Storage model enable many of the most powerful features gracing the new wave of Windows 95 applications. The Office Binder, the "stencil" metaphor of both Visio and TriSpectives, and the componentware market all depend on the Windows 95 implementation of Structured Storage.

Application developers are accustomed to assigning file handles and reserving files for a single application, but compound documents allow many applications to write to a single file. Without an OS-level mechanism for handling compound files, the developer must keep track of multiple seek pointers and, in effect, build an internal file system.

A Structured Storage implementation solves the problem of compound files by supporting a file system within a file. OLE 2 specifies a file structure that can contain two distinct types of objects—storage objects and stream objects. Streams hold data (such as the text in a Word file), while storage objects can hold within them any number of substorage objects or streams. Substorage objects (like subdirectories of a root directory) can, in turn, hold other substorages or streams. Each of these object types expose interfaces (in this context, an interface is an array of functions that other objects or applications can call).

Structured Storage frees an OLE container application from managing its own file structure. Instead, the OLE container provides a storage object to any compound document (or other embedded object) that it hosts. The object then manages the streams and substorages under its control. The application container no longer has to manage the complexity of multiple file pointers. In fact, the application doesn't have to do any work at all. The storage object writes directly into the piece of storage under its control without any interaction with the container itself.

OLE Structured Storage also makes data exchange more robust. Under OLE 1, data was transferred through DDE's mechanism of global memory. OLE 2 applications simply pass a pointer to a data object from the source application to the data recipient. This mechanism is implemented through the OLE 2 interfaces to storages and streams. Future versions of NT (Cairo) will use Structured Storage as its native file system.



any application or directly onto the Windows 95 desktop. Embed Calcblox into an application to enable quick calculations at the click of a button. Listblox lets you jot down to-do items, generate a quick expense report, or embed a simple list manager into your word processor.

Toolblox is the most interesting component. You can launch applications from the toolbar or drag objects (applications, documents, images—i.e., any OLE object) onto it. You can even specify an application's exposed objects as a Toolblox item; for instance, when you drag the Excel icon onto the toolbar and edit the entry, a list box displays Excel's components. You can then select the Excel's calculation engine or its charting module as the launchable component. The toolbar's template icon brings up a wide variety of Officeblox templates for quickly creating agendas, phone messages, meeting requests, or other memos.

Workblox will ship as a "trial" application in Officeblox. Workblox, a tabbed OLE 2 container, gives you a convenient place to store objects or catalog your work.

Product Information

ABC Graphics Suite $495
Micrografx, Inc.
Richardson, TX
(214) 234-1759
http://www.micrografx.com
Circle 1066 on Inquiry Card.

CorelDraw 6 . . . . . $695
Corel Corp.
Ottawa, Ontario
(613) 728-8200
fax: (613) 761-9176
Circle 1067 on Inquiry Card.

Freddi Fish $39
Humongous Entertainment
Woodinville, WA
(206) 486-9258
fax: (206) 486-9694
http://www.humongous.com
Circle 1068 on Inquiry Card.

OfficeBlox $69
AlphaBlox Software Corp.
Burlington, MA
(617) 229-2924
fax: (617) 272-4876
Circle 1069 on Inquiry Card.

Pitfall: The Mayan Adventure . . . $49
Activision
Los Angeles, CA
(310) 473-9200
fax: (310) 479-4005
http://www.activision.com
Circle 1070 on Inquiry Card.

TriSpectives Professional $499
3D/Eye
Ithaca, NY
(607) 257-1381
fax: (607) 257-7335
http://www.eye.com
Circle 1071 on Inquiry Card.

Visio 4.0 . . . . . $249
Visio Corp.
Seattle, WA
(206) 521-4500
fax: (206) 521-4501
Circle 1072 on Inquiry Card.

Visual Voice for Win32 (2 lines) $495
unlimited lines $2995
Stylus Innovation
Cambridge, MA
(617) 621-9545
fax: (617) 621-7862
info@stylus.com or
http://www.stylus.com
Circle 1073 on Inquiry Card.

Windows 95 . . . $209; upgrade, $109
Microsoft Office for Windows 95 . . $499
Microsoft Corp.
Redmond, WA
(206) 882-8080
fax: (206) 936-7329
http://www.microsoft.com
Circle 1074 on Inquiry Card.

The Applications Cometh

When all is said and done, Windows 95 won't require a few killer apps to succeed. It is the shear breadth of supported applications that drives the popularity of the Windows platform. But a wave of significant upgrades and new product announcements can only help fuel the acceptance of Windows 95 across the enterprise and in the home. ■

Stanford Diehl, director of BYTE product reviews, has been evaluating computer products for over 10 years. He holds degrees in English literature, computer science, and electronics technology. You can reach him on the Internet or BIX at sdiehl@bix.com.

Power Mac Gets PCI

The 9500 sports a top-of-the-line PowerPC 604 CPU and PCI bus, too

TOM THOMPSON

With the latest PowerPC 604 processor and a retooled I/O system, Apple's new Power Mac 9500 delivers great performance. Using the industry-standard PCI expansion bus, the latest Power Macs should spawn a wide selection of fast, lower cost Mac/PCI peripherals. Most important, the 9500 maintains software compatibility despite big I/O system changes.

The Power Mac 9500 comes in 120-MHz and 132-MHz versions: the 9500/120 and the 9500/132, respectively. Base RAM starts at 16 MB (expandable to 768 MB) with a 512-KB secondary RAM cache. Standard features include six PCI-bus slots, a 1- or 2-GB Fast SCSI drive, a quad-speed CD-ROM drive, two GeoPort serial ports, and two Ethernet ports (10Base-T and AUI). An internal bus supports SCSI-2 fast transfers, while the external SCSI bus (standard Macintosh DB-25) handles slower external devices.

Next-Generation Design

Apple created a second-generation architecture for the 604. First, there's that industry-standard, 33-MHz PCI expansion bus (see "Inside the PCI Local Bus," February 1994 BYTE). Most internal I/O subsystems use Open Firmware and the PCI bus for start-up configuration and data transactions. Currently, Open Firmware isn't required for PCI card firmware to operate on the 9500 except with boot devices (such as display or network cards). The system also uses Open Transport, a Unix network standard, to implement its network interface and protocol stacks.

The 9500's memory subsystem is 16 to 20 percent faster than those of previous designs. Memory interleaving generates 128-bit-wide memory accesses. The memory controller is smarter about accesses as well; it monitors memory paging to reduce virtual memory overhead and uses DMA for block transfers. It also snoops memory accesses and can thus cache such previously uncachable transfers as I/O and video frame buffers. Finally, copy-back caching algorithms reduce bus traffic.

The memory bus speed is programmable (up to 50 MHz), which enables better synchronization of RAM accesses with the processor bus and allows CPU upgrades (up to a 150-MHz 604), because the 604 sits on a plug-in daughtercard.

It's important to note that the 9500 uses 168-pin JEDEC dual in-line memory modules (DIMMs) instead of the 72-pin SIMMs found in existing Power Macs. If you step up to a Power Mac from an older system with lots of memory, you have two options: You can pony up lots of cash for new DIMM memory, or you can use Newer Technology's DIMM Tree ($69; (800) 678-3726), a slick little gizmo that plugs into the 9500's DIMM sockets and provides SIMM sockets for your old RAM (provided it's 70-nanosecond or faster).

Hard disk I/O has been a Power Mac bottleneck, but the 9500 fixes that with native code for the SCSI driver instead of 680x0 code. (However, file system software is still 680x0 code that undergoes emulation.) Last, the SCSI and other I/O subsystems use a descriptor-based DMA control that minimizes CPU involvement (see "Smarter DMA" on page 124).

The 9500 ships with a tuned up OS, System 7.5.2. Its faster 680x0 emulator uses dynamic recompilation (see "Building the Better Virtual CPU," August BYTE). Other OS optimizations include more native code (such as in the SCSI Manager), some device drivers, and network protocol stacks. Existing native portions of the OS, such as QuickDraw, the math library, and Memory Manager, are tuned for the 603 and 604.

CRAIG ALNESS © 1995

The Apple of your dreams: a 132-MHz 604-based Power Mac.

Trial Run

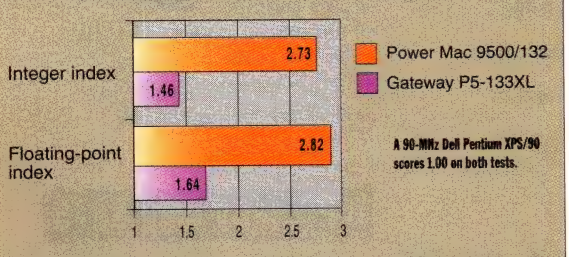
We tested a Power Mac 9500/132 with 32 MB of RAM, a 2-GB hard drive, and ATI's Mac-adapted PCI display card. The ATI card uses QuickDraw's new acceleration API, which makes for snappy screen drawing. With the 604, the Power Mac pulls substantially ahead of similar-speed Pentium systems in both integer and floating-point performance, thanks to a faster CPU and compiler improvements (see the figure "PowerPC Surpasses Speediest Pentium"). An improved compiler enhances a system's performance in our native-mode benchmarks, just as it will enhance application speed.

Low-level 680x0 tests show that the 9500 memory subsystem is several times faster than that of a 110-MHz 601-based Power Mac. On application tests, disk I/O was also noticeably faster. Considering the complete overhaul of the Power Mac bus and network interface, there are surprisingly few incompatibilities. The usual

Product Information

Power Mac 9500
with a 132-MHz 604, 16 MB of RAM, and a 2-GB hard drive $5799
with a 120-MHz 604, 16 MB of RAM, and a 1-GB hard drive $4999
Apple Computer, Inc.
Cupertino, CA
(800) 776-2333
(408) 996-1010
fax: (408) 974-6412
Circle 1065 on Inquiry Card.

PowerPC Surpasses Speediest Pentium



Running BYTE's Native Performance Benchmark at similar clock speeds, the PowerPC 604's integer performance is 87 percent faster than that of a 133-MHz Pentium machine, and floating-point performance is 72 percent faster. We used Motorola's latest PowerPC libraries to compile the test.

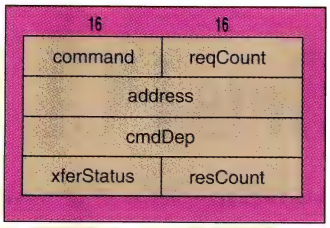
TECHNOLOGY FOCUS

Smarter DMA

By handling memory transfers for the CPU, a good direct memory access (DMA) system improves overall performance. Still, moving large blocks of data between memory and a device, or vice versa, requires multiple DMA transfers. Typically, each transfer ends in an interrupt to the CPU, which must then drop what it's doing to set up the next transfer. To manage its 14 DMA channels without this overhead, the 9500 employs a descriptor-based DMA engine.

Descriptors serve as a simple instruction set for implementing DMA transfers. Glue logic around the DMA controller executes the instruction set, which supports branching, looping, and error handling. Each descriptor is a four-long-word data block with 16- and 32-bit fields that include the command, requested data size, buffer address, a device-specific instruction, status, information, and the resulting amount of data moved. Not all commands use all fields. By chaining descriptors into a mini-program, descriptor-based DMA moves large data blocks without interrupting the CPU.

Taking advantage of descriptor-based DMA requires device-driver modification. The driver must parse each I/O request for size and location and then place in memory sufficient descriptors to handle the transfer. SCSI, Ethernet, sound, serial, and floppy subsystems use this capability to reduce CPU overhead in the 9500.



By chaining DMA descriptors to describe and execute DMA transfers, the 9500 reduces CPU overhead.

assortment of applications, Control Panels, and Extensions—both native and 680x0—functioned as they should. Lotus's cc:Mail worked over the network connection with just one nonreproducible glitch.

We experienced troubles with downloads using Aladdin's SITcomm terminal program. When a noisy connection caused this normally reliable program to abort a ZMODEM transfer, it failed to recover. We also discovered that an old SCSI tape drive would hang the system unless we switched on the drive after the 9500 booted.

It's now too soon to tell how well the first Mac-compatible PCI cards will work. Companies such as Rockwell (FDDI network card) and Diamond Multimedia (accelerated display card) should have products shipping by the time you read this.

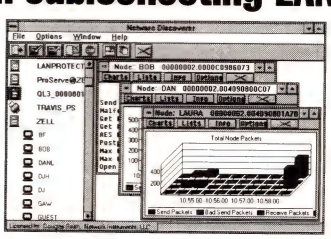
Despite some teething pains, the 9500 provides plenty of horsepower for those who need it. You can expect vendors to correct problems and revise applications to make best use of the 604 processor. In addition, PCI peripherals will cost less and give you higher performance. ■

Tom Thompson is a BYTE senior technical editor at large with a B.S.E.E. from the University of Memphis. He is also an Associate Apple Developer. You can reach him on AppleLink as T.THOMPSON or on the Internet or BIX at tom_thompson@bix.com.

HUNT FOR UNIX TOOLS

UniDirect scouts for PC to UNIX connectivity tools!

Troubleshooting LANs/WANs Using All Your Time?



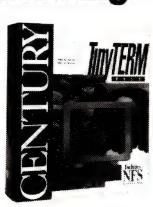
Observer and Analyst/Probe are Microsoft Windows based LAN troubleshooting tools and protocol analyzers. With Observer or Analyst, you can view your LAN more clearly, see network traffic in real time and, with this new information, make network decisions based on facts.

FREE Eval Copy Observer Unlimited Network ONLY $459!

- SAVE HOURS OF NETWORK TROUBLESHOOTING TIME
- Graphical real-time long/short term bandwidth utilization
- Statistics by station, protocol, or packet size distribution
- Auto-discover network addresses, auto-alias Novell names and TCP/IP addresses
- Packet capture decodes with pre- and post-header filtering
- Review Ethernet and Token Ring vital sign displays (broadcasts, hard/soft errors, etc.)
- Triggers & Alarms: activate message windows, captures, logs, or exec external programs
- Filter by protocol, sub-protocol, or user defined sequence offsets
- Detect duplicate IP addresses
- Chart TCP/IP network usage by *telnet*, *ftp*, NFS, and LPD/LPR
- Fully decode TCP/IP, IPX/SPX, NetBIOS, NetBEUI, NetBIOS over IP, and Appletalk
- Use Netware Discoverer to map your Netware LAN and to chart and display Netware trends
- Software-only MS Windows solution - no additional hardware required
- Have Ethernet and Token Ring support
- Use VxD Windows drivers for NDIS and ODI
- 20% the cost of comparable products

✓ Analyst/Probe for multi-segment LANs

Low-Cost PC-to-UNIX Networking!



TinyTERM Plus from Century Software gives you complete connectivity with a variety of emulation modes. TCP/IP, LPR/LPD printer sharing, FTP file transfers, NFS option and more! Ask about our Windows 95-to-UNIX connectivity solutions!

5 PC copy only $279

1-800-613-1683 *Where the Corporate World Connects to UNIX*

WebSite: http://www.unidirect.com • fax 714-707-3095 • ph 714-453-2999 • AD9003

UniDirect

Circle 142 on Inquiry Card (RESELLERS: 143).

They'll be asking how you did it!

Imagine having the power of a wizard. Being able to give a magic touch to what you see around you! Do you really want to turn the world upside down, – or just change the colour of a friend's face? Well, it's all here: The Image Wizard™ imaging system lets you capture high quality colour video images with a simple Click & Freeze. Then it gives you the power to manipulate the image to the limits of your imagination, all with easy-to-use Wizard software.

A complete imaging system

If you have a desktop or portable PC with a PCMCIA card slot and access to video sources such as VCRs, camcorders, TVs, laser discs etc., then all you need is the Image Wizard from MRT. The video capture system consists of a PCMCIA card type I, a video adaptor cable, the Image Wisard software package and an easy-to-follow user manual.

What you see is what you can get!

The Image Wizard software is a powerful Windows-based image enhancement tool which allows colour correction and retouching in an amazingly easy-to-use package. You can blend, lighten, darken, sharpen, remove blemishes, change colours and cut-and-paste to your heart's content. Combine your own video images with the sample images included on the diskettes. In addition to video sources, Image Wizard also provides direct support for scanners and PhotoCD. If you can see it, you can paste it into your document with a resolution of 511 x 511 pixels and 24-bit true colour. Best of all: The process is exceptionally quick and easy.

Check out Image Wizard at your nearest PC store. It cannot fail to impress you.

Kostra

MRT micro as.
Strømsvn. 74, N-2010 Strømmen, Norway
Tel.: +47 63 89 20 20 Fax: +47 63 80 12 12
USA Tel.: +1 603 465 2830 Fax: +1 603 465 2680
Germany Tel.: +49 8092 880 77 Fax: +49 8092 880 76

All trademarks in this document are the property of their respective owners.

Circle 144 on Inquiry Card (RESELLERS: 145).

From the Editors of BYTE Magazine . . .

Available NOW!

BYTE on CD-ROM

FIVE YEARS OF BYTE AT YOUR FINGERTIPS!

- Cover Stories
- Product Reviews
- BYTE Lab/NSTL Reports
- Benchmarks
- Features
- Core Technologies Columns
- Product and Technology News
- And Much *More!*

Introductory Offer: **SAVE $5** off the regular price!

Place Your Order Today!
Call 1-800-924-6621
or FAX your order
609-426-5592

SEARCH
for product, technology, company, author

SELECT
copy and print what you need!

LOCATE
the information you need quickly and easily from your BYTE issues library

EXPORT
selected articles to your word processor

FIND
search results in context, by issue, or by article title

SCAN
the comprehensive index in as much detail as you need

Order Now & Save!
Order BYTE on CD-ROM today for only $54.95 and receive the full text of BYTE from 1990-1994 PLUS quarterly updates on CD-ROM that include full text and graphics from every issue in 1995! Or order the full text of BYTE on CD-ROM (text only) from 1990-1994 for only $39.95.

❑ Send me BYTE on CD-ROM *PLUS* 1995 quarterly updates with full text and graphics for just $54.95
❑ Send me BYTE on CD-ROM with the full text of BYTE from 1990-1994 for just $39.95.

Charge my: ❑ MasterCard ❑ Visa ❑ Amex ❑ Check enclosed (make checks payable to BYTE Magazine, US Funds Or

Card # _____ Exp. Date _____ Signature _____

Name _____ Address _____

City _____ State _____ Zip _____

Mail to: **BYTE on CD-ROM**
PO Box 526, Hightstown, NJ 08520

Circle 66 on Inquiry Card. **CDBY653**

Canadian and US orders, please add $2.95 for shipping and handling, and state sales tax where applicable (Canadian orders add appropriate GST.). Outside North America, add $5.00 for air mail delivery. Allow 6-8 weeks for delivery.

BYTE *1-800-924-6621* **Credit card orders only**

Because the *Experts* decide.

Au Revoir, Mon Ami

Word Pro, formerly Lotus Ami Pro, touts innovative features, but they may not be enough to convert Microsoft and Novell users

KENNETH M. SHELDON

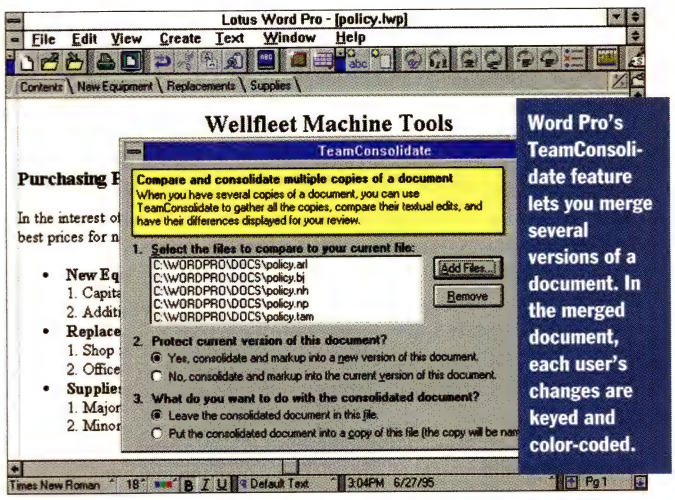
When Ami Pro first arrived on the scene, it was the leader among Windows word processors, thanks to such innovative features as WYSIWYG and style sheets. But it hasn't seen a major revision since July 1992, and its competitors—notably Microsoft Word for Windows and Novell's WordPerfect for Windows—have passed it in both power and popularity.

Still, die-hard believers have stuck with Ami Pro, hoping for a competitive upgrade. Finally, the faithful have been rewarded with so many new features that Lotus decided to give Ami Pro a new, if less original, name: Word Pro.

The Team Approach

The most significant new features in Word Pro stem from Lotus's cross-application team-computing effort. Among these features are TeamReview and TeamConsolidate, which allows you to share documents with other people—each of whom can make edits and revisions—and then consolidate the changes into a final document.

The TeamReview Assistant feature enables you to specify who reviews a document, what kinds of changes are allowed, and through what medium the document is to be routed. Team members can make changes, highlight text, and add comments (including text, graphics, and even sound and video clips).



Word Pro's TeamConsolidate feature lets you merge several versions of a document. In the merged document, each user's changes are keyed and color-coded.

Using TeamConsolidate (see the screen above), you can then merge all the changes and comments—all keyed and color-coded for each team member—into a single document. Word Pro's version control lets you maintain several versions of a document in a single file (see the Technology Focus box at left for more details).

Lotus's team-computing philosophy is also evident in a feature called Notes/FX. This component allows Lotus Notes users to integrate Notes databases with Word Pro to create customized applications and documents.

Some Things Borrowed

Word Pro has adopted some slick features from other applications. For instance, divider tabs let you jump quickly to a specific section of your document. You can also link a divider tab to an external document or an OLE file.

Another borrowed feature, the InfoBox, originated in Lotus Improv and is now common across the Lotus SmartSuite applications. The InfoBox places all the editing and formatting tools for objects such as text and frames in a standardized, context-sensitive box.

The spelling checker, much improved, now supports interactive spell-checking as you edit. When you invoke Spell Check, it automatically highlights all the misspelled words in a document. You can quickly scan the document for true mis-

TECHNOLOGY FOCUS

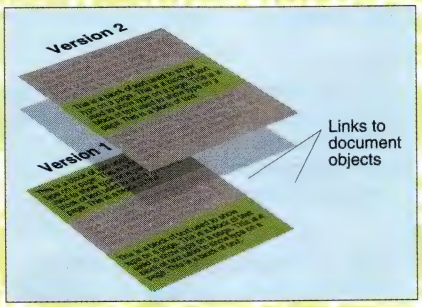
Object-Based Version Control: The Big Difference

Word Pro's version-control features rival the tools found in software development and document management programs. For example, the first time you save a document, Word Pro stores everything in a single read-only file. As you make and save changes, Word Pro saves only the changed portions of the original. A searchable history of the document is always available, and disk space is conserved.

To manage such changes, Word Pro turns major document elements into objects, which are then tracked in a coded list embedded in the file. Users can't view the list, although they can see an editable directory of versions. Versions share objects, including document properties, embedded or linked objects, OLE objects, equations, and charting objects.

A shared object is, in effect, externally linked to all file versions. For example, if you create a chart in a Word Pro document and then update it in a second version of the file, the second version does not contain a full copy of the chart. Instead, the copy is maintained in the original version and linked to the new portions in subsequent versions. When you change data, the original chart is modified, and all links are updated.

Reused objects must be maintained in a read-only state to avoid ripple effects in later versions. For getting around this limitation, Word Pro lets you cut and paste previous versions of a document into a new one. You can also save versions in separate disk files.



Versions of a document are pieced together from linked objects containing the most recently modified elements.

takes and edit them without deactivating the Spell Check dialog box.

Lotus has replaced the macro facility in Ami Pro with LotusScript, an object-oriented, cross-application scripting language that will eventually work across the entire suite of Lotus products. Unfortunately, you can't use it to run a macro from a keyboard combination. However, you can save scripts as external files or attach them to particular SmartMasters, the successors to Ami Pro's style sheets.

And, with Word Pro's script editor, you can link scripts to specific events, such as opening a document or clicking on a frame. Lotus says that Word Pro will run many Ami Pro macros. Given Microsoft's support of Visual Basic for Applications and WordPerfect's cross-application scripting, Lotus will certainly have a hard time differentiating its product line with LotusScript.

Playing Catch-Up

Some of Word Pro's features simply bring it up to speed with its competitors. SmartCorrect, for example, corrects typos on the fly and lets you add words that your fingers commonly mistype. Multilevel undo now lets you undo nearly any change that you've made to a document, and the automatic timed-save feature now saves untitled documents.

As for performance, we found a late beta version of Word Pro poky running on a 66-MHz 486 (see the table "Measured Words"). Word Pro will not score any points for performance.

However, dedicated Ami Pro aficionados will like Word Pro. It adds plenty of new features and improvements while retaining a comforting familiarity. In addition, those who perform their computing tasks in groups—especially users of Notes, 1-2-3, and other Lotus applications—will undoubtedly welcome Word Pro's improved integration with those programs.

MEASURED WORDS

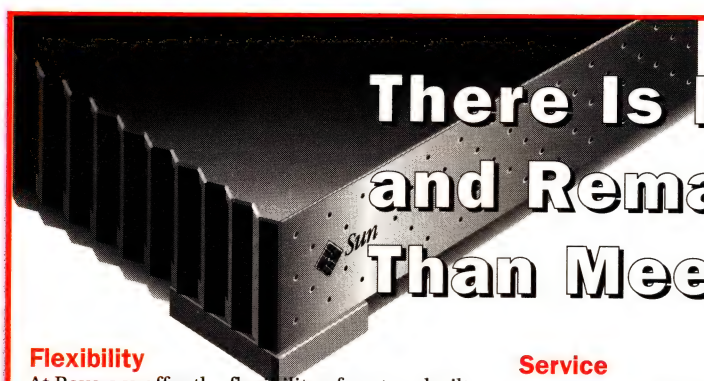
	OPEN AND CONVERT 10-KB FILE (IN SECONDS)	FILE SIZE AFTER CONVERSION (IN KB)
Lotus Word Pro	8	19
Microsoft Word	1	18
Novell WordPerfect	1	11

Word Pro's chances in the overall word processing race are less certain. While features like TeamReview and TeamConsolidate are more powerful and easier to use than anything found in pre–Windows 95 versions of Word and Word Perfect, a number of Word Pro's flashiest features are merely different—not necessarily better—ways of doing things. Word Pro is good enough to hold on to its believers, but it may not be innovative enough to woo a new generation of converts. ■

Kenneth M. Sheldon is a freelance journalist and a former BYTE West Coast bureau chief. You can contact him on the Internet or BIX at ksheldon@bix.com.

Product Information

Lotus Word Pro $105
(estimated retail price)
Lotus Development Corp.
Atlanta, GA
(800) 343-5414
(404) 391-0011
http://www.lotus.com/
Circle 1030 on Inquiry Card.



There Is More To Rave and Remanufactured Sun Than Meets The Eye...

Flexibility
At Rave, we offer the flexibility of custom built systems that meet your specific needs. We will build your Sun system to your requirements and can even offer options not offered by Sun. As an authorized reseller of major power enhancement products, Rave can offer the power of a ROSS 125 MHz processor to your Sparc 10 and 20, or MP servers. We can double the speed of your IPX or SPARC 2 with a WEITEK chip. We can upgrade your SPARC 1, 1+ and SPARC 2 to the power of a SPARC 5, 110 MHz, with an Axilerate™ (accelerator) board from Axil Computer.

ROSS TECHNOLOGY, INC. A SUBSIDIARY OF FUJITSU, LTD.
WEITEK
Axil

Availability
We offer a full line of Sun equipment, peripherals and compatibles: from Sparc 1 to Sparc 20, servers, options, memory, disks to cables and software.

Service
Our Sun certified engineers will assist you with any technical difficulties. Our team of experienced account managers provide optimal configuration of products and software which fit the demands and budgets of large and small companies.

Support
Our engineers take pride in being vendor trained in all the products we sell. We offer full warranties, right to use licenses, pre-loaded operating systems, documentation, configuration consulting and technical support.

Savings
When you buy from Rave you not only save money, you also save valuable time. Our committment to provide the highest quality products and service enhance your savings.

HUGE SAVINGS
Off List Price
SPARC 1, 2, 5, 10 & 20's
Immediate Delivery
Call today for free brochure with all our latest discounts

Rave Computer Association, Inc.
36960 Metro Court
Sterling Heights, MI 48312
Fax:
(810) 939-8230
1-800-966-7283
E-Mail: sales @rave.com

RIDE THE WAVE RAVE COMPUTER ASSOCIATION, INC. SAVE WITH RAVE

Circle 141 on Inquiry Card.

Digital Cameras for Real Work

New sub-$1000 digital cameras strike a practical balance between price and image quality

ALAN MORGAN AND SCOTT WALLACE

The benefits of digital photography—filmless cameras that feed images directly to your computer—have always been obvious, especially for field work such as insurance and real estate applications. The high cost of this new technology has been just as obvious. But now affordable digital cameras, priced just under $1000, support new ways of using digital images in business, scientific, and publishing applications. Though they can't rival scanners in resolution or fidelity, they dramatically improve ease of use and reduce production time.

The trio of cameras reviewed here—from Apple, Kodak, and Logitech—are based on the same Kodak core. These 24-bit cameras are similar in form and function but differentiate themselves in storage capacity, operator controls, and approach to image processing. Casio's new QV-10 is a different breed altogether (see "Casio's QV-10: Portable Presentations" below), and suggests the direction future digital cameras may follow.

The three Kodak-based cameras all share the lightweight feel of a point-and-shoot film camera, including built-in flash and removable batteries. The Kodak and Logitech cameras can also take some third-party lenses. All three store image data in EPROM flash memory, which retains images even when batteries go dead.

CRAIG ALNESS © 1995

Three digital cameras from Apple (top), Kodak (right), and Logitech (left) are all based on a Kodak core product. The Apple has the lowest price ($739) and works with both Macintosh and Windows PC platforms.

The bundled Macintosh or Windows software supports simple image manipulation as well as several compression protocols, such as JPEG and TIFF, for migration to professional-quality applications.

Price still limits image resolution, but increasingly sophisticated processing makes relatively low-resolution data more realistic (see "Imaging Without Film" on page 130). Though they still don't deliver the vibrancy and sharpness of film-based cameras, the new Kodak-based cameras provide significantly better quality than less expensive digital cameras.

Kodak's DC40

Like Logitech's FotoMan Pixtura, Kodak's DC40 (Digital Camera 40) offers more storage capacity than Apple's QuickTake (4 MB versus 1 MB) and higher image

Casio's QV-10: Portable Presentations

While Kodak's DC40 and Logitech's Pixtura produce the best printed picture and Apple's QuickTake 150 has the best monitor display, Casio's new QV-10 stakes out NTSC video as its forte. Due this summer, Casio's entry into the digital camera market provides numerous design innovations that could steer things toward smarter, friendlier image capturing.

The 1.8-inch-square active-matrix color LCD viewfinder on the camera's back says that the QV-10 is not the standard point-and-shoot film box it resembles. Its through-the-lens view frames an object without parallax and brings WYSIWYG to the under-$1000 camera field. You can adjust contrast and framing before taking the picture. Also, you can tilt the lens up or down, switch it to a macro for close-ups, and adjust the LCD's optimal viewing angle. Thus, it's easy to shoot with the camera placed in any convenient location.

The same LCD lets you review all 96 pictures, which you can store in the QV-10's 2-MB flash EPROM. To make comparison easier, the LCD can display four or nine pictures at once (and the images remain recognizable). You can also zoom in on a portion of an image for detail. You can delete any picture in memory, and the remaining shots renumber to make room for more. (In contrast, the Kodak family lets you delete only the latest image, and enabling the delete-last-picture option can reduce storage capacity by 30 percent.)

The camera's weak point is that it captures images at a resolution of only 480 by 240 pixels. All output from the camera is converted to 320 by 240 pixels (or interpolated up to 640 by 480 pixels) so print and VGA output will likely be acceptable only in small sizes. But on a TV or videotape, the image works well.

What will sell the QV-10 is its in-camera presentation abilities. Images are stored digitally but can be retrieved as either digital or NTSC video signals. In "autoplay" mode, the QV-10 displays stored images sequentially at a selected rate. Even better, you can download images from your PC. You can upload images from the camera to a PC, add graphics and lettering, reorder everything, and then download a presentation back to the camera. Hook the QV-10 to a TV, turn on autoplay, and watch the show. It can loop endlessly, including four- and nine-image screen displays, making catchy advertising for store windows or sales booths.

DIGITAL PHOTOGRAPHY: BARBARA BUSENBARK © 1995

TECHNOLOGY FOCUS

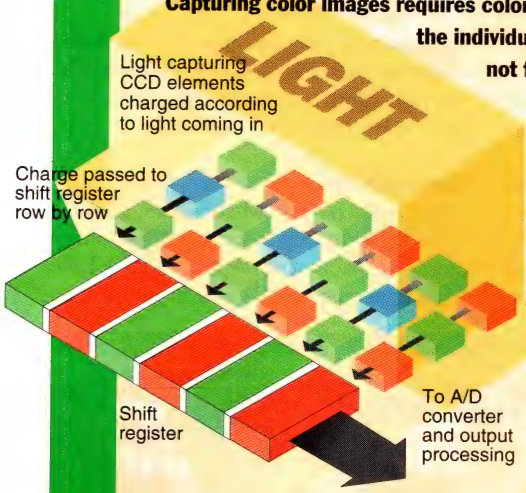
Imaging Without Film

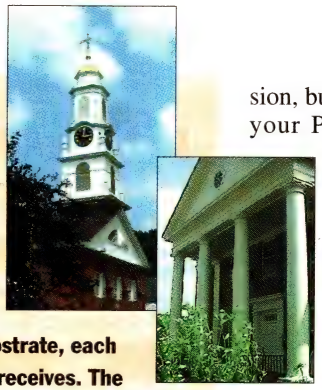
The CCD (charge-coupled device) that converts light to electric charge in today's digital cameras traces its ancestry back to the first black-and-white camcorders. A camera CCD is a single silicon chip that combines a rectangular array of light-sensitive cells with circuitry to process and digitize the image the cells record.

As the camera's shutter exposes the CCD's imaging substrate, each cell builds a charge proportional to the amount of light it receives. The resulting image is read cell-by-cell using a bucket-brigade process that takes 4 to 5 seconds with these cameras. The cells in the bottom row pass their charges to a serial shift register below the array. Cells in the rows above pass their charges down one row.

Cell by cell, the CCD chip reads the contents of the shift register, converting the number of electrons to an amplified analog signal. Row by row, the analog signal is processed into a digital image that is stored in the camera's memory. During this transfer, information from the cells may be discarded or combined to reduce image file size and resolution. Even today's low-end digital cameras compare each pixel to its neighbors and optimize for contrast, hue, and saturation.

Capturing color images requires color filters (red, green, and blue) because the individual CCD cells measure light intensity, not frequency. The simplest technique dyes the surface of each cell to sensitize it to one of the three colors needed. After early missteps (striped arrays that reduced resolution by two-thirds), Kodak developed a checkerboard mosaic of colored pixels based on experience gained with film chemistry. The resulting Bayer Pattern CFA (color filter array) has more greens than reds and blues (see figure), since human visual systems perceive that ratio as "sharper."





resolution (768 by 512 pixels versus 640 by 480). After analyzing captured data with a "nearest neighbor" algorithm, all three cameras compress it with Kodak's proprietary RADC algorithm. RADC creates some edge artifacts but otherwise packs information into less memory with less quality loss than Kodak's older 80PCM algorithm (used in Apple's QuickTake 100).

Easy to set up, the DC40 combines plug and play with point and shoot. The controls are easy to use. The camera's four AA lithium batteries are good for about 500 pictures (depending on flash use and how many images you download to a PC) and support a 5-second cycle time between shots when fresh.

Storage capacity and resolution options are the primary differences between the three cameras. The Kodak camera takes 48 or 99 pictures, depending on compression, but you must make the choice from your PC when the camera is empty. Choose the higher compression rate only when you'll display the pictures very small or in gray scale.

The PC connection is quick—simply run the cable from your serial port to the camera. With the bundled PhotoEnhancer software, you can view stored images as slides and download them to your computer. The software lets you perform any of a simple menu of image manipulations with ease. A helpful preview feature displays nine variations of the image at once. Kodak released Mac software in July.

The Kodak and Logitech cameras offer you more control than the Apple, as you can alter exposure ±2EV on the fly. Telephoto and wide-angle lenses are available from such manufacturers as Tiffen to augment the built-in 42mm-equivalent lens.

Apple's QuickTake 150

Not surprising, Apple's QuickTake 150 works with both Windows-based PCs and Apple Macintosh computers. Both versions ($739) come with appropriate cables and bundled software; the Macintosh software provides more features.

Although the Kodak-manufactured QuickTake 150 looks similar to the DC40, Apple cut the price 25 percent partly by not using unnecessary CCD (charge-coupled device) pixels. Using only a 640- by 480-pixel matrix, the QuickTake matches the most common monitor resolution. Having 86,016 fewer pixels to process speeds up operations from capture through transfer to display, and saves disk space, too. Additional cost savings come from reduced storage memory, simpler controls, fewer batteries, and elimination of the lens mount. The resulting lighter camera feels less substantial than the DC40 or the Pixtura, but delivers comparable images.

The QuickTake's 1 MB of memory holds only 16 to 32 images, but you can mix different quality shots in the same session. For lower-quality shots, both Apple and Kodak decided that compressing pixel data causes less "quality loss" than

Product Information

Digital Camera 40 . . . $995
Eastman Kodak Co.
Rochester, NY 14650
(800) 235-6325
(716) 724-4000
http://www.kodak.com
Circle 1061 on Inquiry Card.

FotoMan Pixtura $995
Logitech, Inc.
Fremont, CA
(800) 231-7717
(510) 795-8500
fax: (510) 792-8901
Circle 1062 on Inquiry Card.

QuickTake 150 . . . . . $739
Apple Computer, Inc.
Cupertino, CA 95014
(800) 538-9696
(408) 996-1010
fax: (800) 462-4396
http://www.apple.com
Circle 1063 on Inquiry Card.

QV-10 . . . . . $995
Casio, Inc.
Dover, NJ
(800) 962-2746
(201) 361-5400
fax: (201) 361-3819
casiotech@aol.com
Circle 1064 on Inquiry Card.

The Art of Smart

SmarTerm for Windows offers a true MDI interface and automation tools to reduce support costs.

SmarTerm's TCP/IP stack offers drag-and-drop FTP and an FTP file viewer for easy file transfers.

TCP Addition™ for SmarTerm provides a sophisticated PPP/SLIP dialer for efficient remote access.

SmarTerm® is a fine art form. High-end host connectivity and TCP/IP make SmarTerm the corporate standard of choice for DOS, Windows, Windows NT, and Windows 95. Whether you need VT, TN3270, Data General, SCO Console, ANSI BBS, TCP/IP, LAT, PPP, or SLIP–SmarTerm is your very own masterpiece.

Persoft has painted an entire series of SmarTerm emulations, added a completely Windows-based TCP/IP stack (a Windows Sockets DLL), and given you the power to create your own work of art with its automation tools. If you want the Art of Smart, then you want the Art of SmarTerm.

Call us today at 1-800-TCP-3130 to qualify for a 90-day evaluation.

Persoft, Inc., 465 Science Dr., P.O. Box 44953, Madison, Wisconsin 53744-4953 U.S.A.
Phone (608)273-6000, Fax (608)273-8227, Sales: 1-800-EMULATE or sales@persoft.com,
World Wide Web: www.persoft.com

Persoft Inc, European Headquarters, Lower Woodend Barns, Fawley, Henley-on-Thames, Oxfordshire, RG9 6JF, United Kingdom
Phone +44 (0)1491 638090, Fax +44 (0)1491 638010

persoft®
CONNECTIVITY SOLUTIONS
DOS • Windows • Ethernet • Token Ring

Copyright 1995 Persoft, Inc. All Rights Reserved. SmarTerm and Persoft are registered trademarks and TCP Addition is a trademark of Persoft, Inc. All other trademarks are property of their respective owners.

Circle 86 on Inquiry Card.

Save Disk Space

PKZIP®

PKZIP version 2.0

PC WORLD WORLD CLASS AWARD

PKWARE® introduces the next generation of its award winning compression utility. PKZIP 2.0 yields greater performance levels than achieved with previous releases of the software. PKZIP compresses and archives files. This saves disk space and reduces file transfer time.

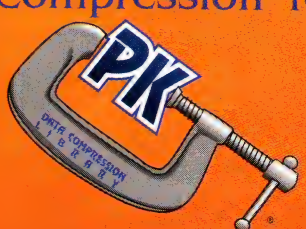
Software developers! You can significantly reduce product duplication costs by decreasing the number of disks required to distribute your applications. Call for Distribution License information.

Put Your Executables on a Diet

Software developers! Save disk space and media costs with smaller executables. You can distribute your software in a compressed form with PKLITE Professional.® PKLITE Professional gives you the ability to compress files so that they cannot be expanded by PKLITE. This discourages reverse engineering of your programs.

PKLITE increases your valuable disk space by compressing DOS executable (.EXE and .COM) files by an average of 45%. The operation of PKLITE is transparent, all you will notice is more available disk space!

Compression for YOUR Application



The PKWARE Data Compression Library® allows you to incorporate data compression technology into your software applications. The application program controls all the input and output of data, allowing data to be compressed or extracted to or from any device or area of memory.

All Purpose Data Compression Algorithm compresses ASCII or binary data quickly. The routines can be used with many popular DOS languages. A Windows DLL and an OS/2 32-bit version is also available!

PKWARE® INC.

The Data Compression Experts®

9025 N. Deerwood Drive Brown Deer, WI 53223-2437

(414) 354-8699 Fax (414) 354-8559

PKWARE, INC. WEB SITE # http://www.pkware.com

PKWARE Data Compression Library for DOS $275 PKWARE Data Compression Library for OS/2 $350
PKWARE Data Compression Library DLL for Windows $350
PKZIP $47.00 PKLITE $46.00 PKLITE Professional $146.00

Please add $5.00 S&H per package in the US & Canada. $11.25 overseas.
Wisconsin residents add appropriate state sales tax & county sales tax.
Visa and Mastercard accepted, no COD orders.

BY1095

Circle 89 on Inquiry Card.

sampling fewer pixels—the approach taken by most cameras, including the Pixtura.

Of the three, the QuickTake is the simplest to operate, with fewer display-panel options and controls that are easier to figure out. The cycle time of 4 seconds between shots is faster than that of the DC40. Three AA batteries support only 200 pictures, but an optional external battery pack with eight AA cells can take thousands.

The fixed 50mm-equivalent lens focuses from four feet to infinity, and a snap-on close-up adapter with flash diffuser allows pictures in the 10- to 14-inch range. A parallax-correction lens is included for the view finder, which, like the other cameras, is not WYSIWYG.

Logitech's FotoMan Pixtura

The FotoMan Pixtura and the DC40 cameras are identical in appearance and nearly identical in features. At its default resolution, however, the Pixtura holds 144 pictures in its 4-MB memory, more images than any of the tested cameras. Logitech achieves this by making "standard" resolution 384 by 256 pixels and "high" resolution 768 by 512 pixels, rather than using increased compression as Kodak and Apple do. A memory management quirk shared by the Pixtura and the DC40 is that if you enable the "delete last picture" option, it reduces the capacity for high-resolution images from 48 to 31.

The Pixtura's Digital Eyes software (from Day One) supports a function not included with the others. You can adjust the compression rate for exported JPEG format files on a continuous scale from minimum to maximum, which lets you reduce file size greatly if your application can stand the data loss.

Parting Shot

With improved resolution and image processing, these midrange digital cameras will increase use of digital photography in business and professional applications. We preferred the QuickTake's controls and price; at $739, it's $250 under the others. However, the DC40 and Pixtura have a hand strap, higher capacity, and the ability to take additional lenses. Overall, Apple's QuickTake 150 is still the best buy. ■

Alan Morgan, a programmer for 15 years, is a freelance writer and photographer who no longer looks down his nose at digital cameras. You can reach him at amorgan@equinox.ShaysNet.com. Scott Wallace is a former BYTE technical editor who can be reached at editors@bix.com.

Let's Get Small

Super-small and super-smart, new microcontroller development systems are changing the shape of embedded design

RICK GREHAN

Miniaturization has created a new twist in the world of embedded design: The development system is also the target system—you design on the system that you deploy. Your PC becomes the development host and is tethered to the target via a serial cable or a specialized parallel cable.

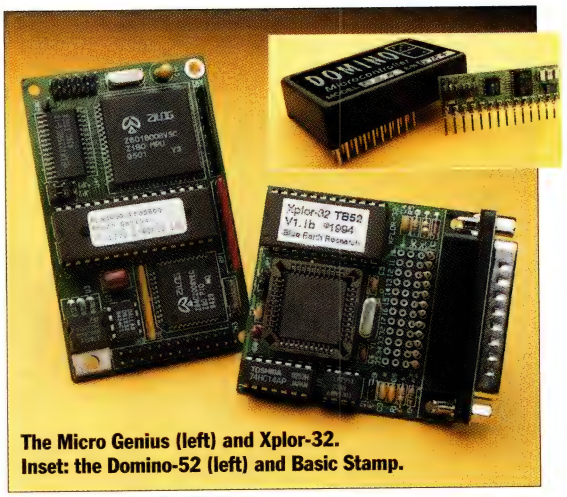
Four development boards from Blue Earth Research, Micromint, Parallax, and Z-World are indicative of this trend. Such systems can include as few as two chips plus a few glue components for power-supply regulation and communications.

The Stamp

Parallax's Basic Stamp is currently king of the miniature hill. Two chips—one serving as the processor, the other acting as the serial EEPROM—do it all (not counting the support circuitry). It all fits on a 16-pin single in-line package (SIP), which you plug into a carrier board during development. The board is not much bigger than the 9-V transistor battery that powers the whole thing. A special cable connects the Stamp to your computer's printer port.

You program the Stamp in an admittedly anemic dialect of BASIC. But this becomes understandable when you recognize that you're working with just 256 *bytes* of program space and 14 *bytes* of variable space.

Parallax has offset the language's limitations, however, with specialized commands. For example, a single Stamp BASIC command can emit a pulse train out of an I/O-port pin (the Stamp has eight of them) with a specified duty cycle.



The Micro Genius (left) and Xplor-32.
Inset: the Domino-52 (left) and Basic Stamp.

The Domino Effect

Micromint's Domino-52 comes in a solid epoxy package that looks like an oversize IC (it measures 1.1 by 1.75 inches). Inside is an 80C52 processor with ROM BASIC as well as 32 KB of static RAM (SRAM) and 32 KB of EEPROM (for program storage). A row of 20 pins along the underside provides an 8-bit bidirectional I/O port, a pair of interrupt lines, a serial port, and access to an optional 12-bit, two-channel A/D converter.

As with the Stamp, you program the Domino-52 by plugging it into a carrier board that provides power regulation and communications hardware. Micromint also offers an optional multiwindowed host-based integrated development environment (IDE), called Host52, that serves as an editor/terminal program.

The BASIC dialect understood by the Domino is BASIC52, a reasonably orderly version that's far more robust than the Stamp's BASIC. It supports floating-point, one-dimensional arrays and a kind of rudimentary string handling.

Micro Genius

Compared to the other devices in this review, Z-World's Micro Genius is a Hulk Hogan of capabilities. It uses a Zilog Z180 that runs at 6.144 MHz. The Z180 is a descendant of the venerable Z80 processor with mutated abilities that include, among other things, addressing for up to 1 MB of memory.

The Micro Genius can support a variety of memory configurations. Its base version comes with 32 KB of SRAM and 32 KB of EPROM. The EPROM is socketed, allowing the system to support up to 512 KB of EPROM or 256 KB of EEPROM.

The base-model Micro Genius also includes an RS-232 port (used for communications with the host) and a 555 timer IC configured as an analog input channel for measuring external resistance. Without consuming any additional board space, an upgraded version also has a real-time

TECHNOLOGY FOCUS

Serial Chips

Two things consume board space: parts and traces. The two-chip Basic Stamp reduces the parts count about as far as you could—or would want to—go. Minimizing traces is another matter; you have to be able to get data back and forth between the chips.

That's where serial chips help. For example, the 93LC56 serial EEPROM holds 256 bytes, which for most EPROMs would mean eight data lines and eight address lines to the host CPU. On the 93LC56, that's all handled by four wires: one for chip selection, another for the clock signal, and two more for data in and out. A clever designer can multiplex data in and out, bringing the number of wires down to three.

To read a byte, the CPU sends a command packet to the EEPROM. This command consists of a read op code, followed by the address bits. The EEPROM decodes the command and responds with the 8-bit contents of the requested address. A similar protocol controls write operations. Bits flowing along the data line are synchronized by the clock signal.

Transfers between the CPU and EEPROM can be as fast as 2 Mbps. This is a lot slower than a conventional bus, but plenty fast considering the board-space savings.

Product Information

Basic Stamp
With carrier board...$54
Parallax, Inc.
Rocklin, CA
(916) 624-8333; fax (916) 624-8003
info@parallaxinc.com
Circle 1026 on Inquiry Card.

Domino-52
Without A/D converter...$79
With A/D converter, development board, and software...$198
Micromint
Vernon, CT
(203) 871-6170; fax (203) 872-2204
Circle 1027 on Inquiry Card.

Micro Genius...$79
Standard version for DOS or Windows...$195
Deluxe version...$395
Z-World
Davis, CA
(916) 757-3737; fax (916) 753-5141
Circle 1028 on Inquiry Card.

Xplor-32
Board only...$59.95
Board with cables, power supply, manual, and disk...$99.95
Blue Earth Research
Mankato, MN
(507) 387-4001; fax (507) 387-4008
739-0298@mcimail.com
Circle 1029 on Inquiry Card.

clock and an RS-485 circuit (for building "networks" of Micro Geniuses).

You program the Micro Genius with Z-World's Dynamic C, which includes a full-blown IDE that includes an editor, a C compiler, and a debugger. The IDE lets you open watch windows, evaluate expressions, single-step through the executing program, and even examine CPU registers.

Dynamic C is an extended version of C. For example, it supports *costatements*, types of constructs that allow cooperative multithreading. The number of routines and libraries provided is stunning; the package even includes two real-time kernels.

Exploration

Blue Earth Research's Xplor connects to your PC via the serial port. Programming the Xplor is simply a matter of firing up a communications program and entering BASIC code. Once you've entered and debugged your program, that's all there is to it; the code is automatically saved in the Xplor's on-board 4-KB EEPROM. Turn off the Xplor, install it wherever it needs to be, and the next time power is applied, the Xplor executes your program.

I tested the lowest member of the Xplor family tree: the Xplor-32. Its rudimentary I/O hardware consists of 12 digital I/O lines.

The capabilities of the Xplor's version of BASIC fall somewhere between the Stamp's and the Domino-52's. The Xplor's BASIC understands integers only and has no concept of strings or arrays. It provides a set of commands for controlling program flow, as well as special functions for reading the system's built-in A/D converter (functions that are not available on the Xplor-32) and returning the frequency of a wave form at one of the input pins.

Little Is Big

If you do embedded design, these little systems mean big savings. You don't have to spend money on in-circuit emulators, ROM emulators, EPROM burners, and so forth. All you need is a relatively modest PC and some extra space on your desk. ■

Rick Grehan is a senior technical editor for BYTE reviews. He can be contacted on the Internet or BIX at rick_g@bix.com.

URGENT—YOUR INPUT NEEDED

On: Data Communications and Voice Networking

Dear Reader:

To improve BYTE's coverage of technology in the State of the Art section, we'd like your feedback about what topics, areas, and products we should be considering. Early next year, we plan to take a look at where data and voice communications are heading. How much further can we go with analog phone lines and modems before we switch to digital? How about wireless and cellular modems, cable modems, and set-top boxes? What's happening with simultaneous/alternating voice and data. ISDN is starting to arrive, but getting and using it isn't easy, and we're still waiting for asynchronous transfer mode (ATM). What are the real costs of all these new services? These are complex questions. To do them justice, we'd like to know what you're interested in. We want to hear your ideas and find out about concerns that we may not fully appreciate or be aware of. Also, we'd like your help in knowing who are the people we should be talking to.

To let us know what you think, please use the following as a template to send us, via E-mail, an ASCII text file with your comments. Please be sure to include the <FIELDNAMES> with their angle brackets, followed by your information and comments. And thanks very much for your help.

Please E-mail the completed form to: **surveys@bix.com**

```
<TOPIC>
Whither Data Communications?

<LASTNAME>
Yimmerman

<FIRSTNAME>
Sosatu

<TITLE>
Communications Analyst

<COMPANY>
Data's All, Folks

<PHONE>
800-555-9801

<EMAIL>
sy@host.domainsy@host.domain

<COMMENTS>
```

This is where your comments go. Be as brief or as long as you want. Tell us what you think, what you need, what you want to know more about. Tell us what you're doing. Tell us who we should be talking to.

Rack 'em. Stack 'em. Manage 'em.

Six and 12-port hubs combine with 4-port repeater and IN3000/E intelligent module for up to 52 managed ports.

New Compex hub system.

Managing network growth just got easier. Because with the Compex modular, manageable hub system you can add ports quickly at a surprisingly low cost per port.

Installation is easy, too, because you can stack or rack-mount Compex hubs in a wide variety of configurations up to 52 ports per group.

Combine 6-port Compex TP3000/E and 12-port TP3012/E hubs with the IN3000/E intelligent module and new Compex FreedomView™ network management software that runs on Windows for a powerful, low cost managed SNMP network.

With the Compex hub system, a network can start small, then grow indefinitely. Unlike many hub systems, the TP3000/E and 3012/E don't use data ports for expansion, so all ports are available for node connection. Hubs can be cascaded together to form hub groups, which can then be connected with other hub groups via the BNC connector without performance degradation.

NETWORKED WITH NATIONAL SEMICONDUCTOR

yes It runs with NetWare

Of course, all this performance and versatility has a cost. An amazingly low cost per port!

If you're looking for network growth that's easy and cost-effective, call Compex.

TP3012/E 12-port hub.

COMPEX®

Out-connecting the rest

U.S.A.

COMPEX, Inc.
4051 E. La Palma
Anaheim, CA 92807 U.S.A.
(714) 630 7302
Fax (714) 630 6521

GERMANY

ReadyLINK Networktechnology GmbH
Albert Einstein Strasse 42
63322 Rödermark, Germany
(49) 6074 98017
Fax: (49) 6074 90668

SINGAPORE

COMPEX Systems Pte Ltd
4 Kim Chuan Terrace,
Singapore 1953
(65) 288 8220
Fax (65) 280 9947

© 1995 Compex, Inc. Compex is a registered trademark of Compex, Inc. FreedomView is a trademark of Compex, Inc. All other trademarks and copyrights are the property of their respective holders.

Circle 501 on Inquiry Card (RESELLERS: 502).

MAXIMIZE YOUR MARKETING DOLLARS WITH BYTE REPRINTS!

BYTE Reprints serve as high-quality, inexpensive promotional tools for:

- Trade show handouts
- Direct mail campaigns
- Dealer/distributor promotions
- Training and educating key personnel
- Presentations at conferences/ seminars

And there's more!

- BYTE reprints can be customized with your company name, logo, product picture, etc.

Call today for information and quantity prices.

Susan Monkton
BYTE Reprint Department
One Phoenix Mill Lane
Peterborough, NH 03458
Phone: 603-924-2618
Fax: 603-924-2683

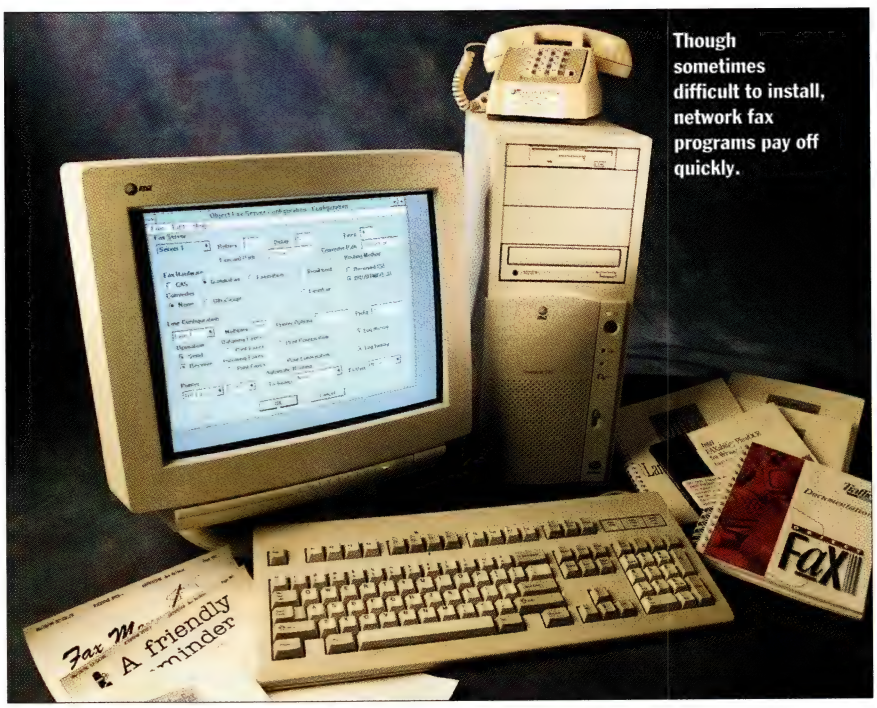
BYTE

A Division of the ***McGraw·Hill*** *Companies*

Industrial-Strength Fax Servers

Six high-end network programs offer company-wide faxing and enough throughput for an entire fax-based business

REX BALDAZO, DAVID ESSEX, AND STAN MIASTKOWSKI



Though sometimes difficult to install, network fax programs pay off quickly.

High-powered, server-based fax software can bring faxing to every network user. By placing the fax boards and telecommunications software in a central location, companies can provide the same functions that would otherwise require more costly individual setups.

Networked DOS/Windows fax programs divide broadly into two categories: low-end/client-based and high-end/server-based applications. In this review we evaluate solutions based on dedicated servers that can use several multiline fax boards to handle hundreds of faxes per hour. We're talking about units that can serve, say, 1000 employees during business hours, then broadcast 2000 revised price lists to customers overnight.

To judge overall quality, we considered ease of installation, ease of use, upward scalability, robustness of administrative features, and compatibility with the widest possible range of fax boards and network OSes. Ignoring reports about the difficulty of installing these complex programs, we set out to do six in one month, learning our lessons the hard way. War stories follow...

FACSys

Optus Software's FACSys 3.40a, a DOS-based fax server for NetWare, packs a surprising number of features and excellent performance into a $995 package.

Installation was remarkably easy. In less than 20 minutes (not including the time it took to set up the fax board), we had FACSys performing its basic functions. After you've logged in to NetWare as a supervisor, FACSys' installation takes care of pesky chores. There's no need to fuss with NetWare's SYSCON or PCONSOLE because FACSys creates its own print queue and grants rights to the group EVERYONE for basic FACSys operation.

One of the most impressive and unique things about FACSys is its wide support of fax devices. Besides the high-performance Brooktrout and GammaLink boards, FACSys supports Intel and PureData units, and all Class 1 and Class 2 fax/modems. Out of the box, it supports up to eight telephone lines and an unlimited number of clients. FACSys also has built-in OCR and built-in E-mail support, including cc:Mail, Novell Groupwise and MHS, and MS-Mail (via MHS only).

Both the DOS and Windows clients include personal and shared phone books and detailed in and out logs (the other five programs offer similar client setups). There's a utility for sending a quick fax, or you can choose the FACSys print queue in Windows Print Manager from your application's print-setup menu.

For its power, FACSys is an excellent value for a small- to medium-size business, especially in view of its wide hardware support and standard features. And it's scalable to larger installations—$2995 buys a multiple-server version that offers fault tolerance and load balancing to handle huge amounts of fax traffic.

continued

The Many Ways to Send a Fax

Network faxing comes in four different flavors:

Low-end to mid-range software. Adds fax functions to existing networks. Some are little more than fax modem-sharing utilities. Includes NetWare NLMs that are somewhat scalable for high-end use. Major players: Delrina's WinFax Pro for Networks and Cheyenne's FaxServe.

Mid-range to high-end software. The focus of this review. Often used for mission-critical applications such as broadcasted price updates. Major players: FACSys, LanFax, RightFax.

Hardware/software bundles. Nice for avoiding the pain of software configuration, turnkey systems are available in all the major capacity ranges. Major player: OAZ Communications' Netfax.

Black box solutions. No monitor, hardly any software-installation issues. A neat little box is the server. Major players: Castelle's FaxPress (pictured), U.S. Robotics' Shared Access.

Fax Resource

Resource Partners' Fax Resource runs its server software on Windows instead of in DOS. The server machine can then launch other applications, even faxing from an application running on the same machine as the fax server. Unfortunately, the reality falls short of the potential.

The main hurdle is DOS's 640-KB memory barrier. Naturally, we had to load the various NetWare drivers to put the server on the network. Then we wanted to load the CD-ROM device driver, as well as MSCDEX. The fax server itself requires a large number of file handles. It all added up to insufficient conventional memory to run Windows.

Eventually, by putting DOS's MEMMAKER utility into aggressive mode, foregoing the CD-ROM driver, and tweaking the Fax Resource INI file manually to disable EMS, we were able to get Windows running. But all that did was push our memory problem into Windows, which now had insufficient resources to run the Fax Resource server. Getting desperate (and mad), we installed PC-DOS 7 and ran RAMBOOST, which finally freed enough memory.

The Fax Resource client software lets you print from any Windows program. Address books are in Microsoft Access MDB format, and you are free to create as many as you want. Installing the client software was easier than installing the server package, but the software would not run until we figured out how to authorize user access. (Similar hurdles cropped up when we installed LanFax and Net Satisfaxtion.)

Fax Resource needs some work. We like the Windows server idea, but the drivers need to be smarter about memory. Given time and revision, this could be a good product.

continued

Only Power Servers Need Apply

We tested the six fax server programs that are best able to grow into high-volume, mission-critical applications. Thus, we didn't test some well-known products, such as Delrina's WinFax Pro for Networks and LANSource's Faxport, that are designed more to add client-level fax features than to undergird a high-volume, fax-based business.

To narrow the field further, we looked for software that runs on NetWare networks (though most also work with Microsoft LAN Manager, IBM LAN Server, and others). Our criteria also specified that all of the programs must run on GammaLink's GammaFax boards, the de facto standard for high-end fax systems, though many also support coprocessor-equipped boards from Brooktrout and PureData.

We didn't test an important subcategory of fax server software, NetWare NLMs, such as Cheyenne's FaxServe. Detractors say some network administrators are leery of hanging extra hardware onto their main servers. Both Cheyenne and competitor Tobit Software have taken steps to address these concerns. Supporters say NLMs are cheaper and more NetWare-saavy.

We installed the programs on a prerelease AT&T Globalyst, a 133-MHz Pentium tower with 16 MB of RAM and an 853-MB hard drive. The server machine was connected to our corporate Novell network via thin Ethernet. We used V Communications' System Commander to choose MS-DOS 6.22, PC-DOS 7, or OS/2 Warp at bootup.

The fax board we used for our testing was a high-end GammaLink GammaFax CP4/LSI, stocked with four analog ports, each configurable for either inbound or outbound traffic.

TECHNOLOGY FOCUS

Inside CSID

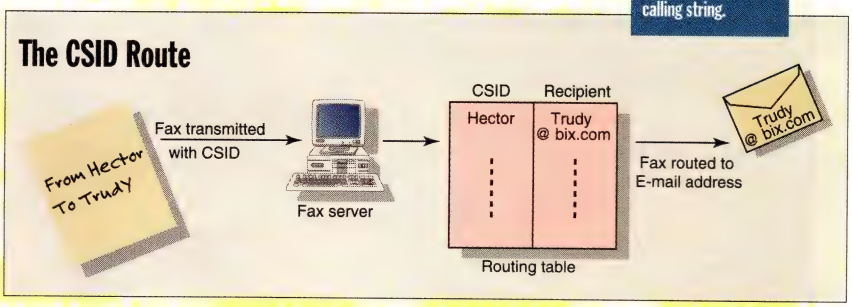
Most fax machines transmit a Call Subscriber ID (CSID) calling string with the faxes they send. The CSID value can be programmed into the fax machine or entered into a field from the fax software. This subscriber ID is intended to label the specific fax machine, but you can use the string to support different methods of automatic routing.

For CSID routing, the fax software builds a table that associates CSID strings to network nodes or E-mail addresses. The software captures the string, then routes the fax to the associated network station or sends the fax via E-mail. The table can also associate a group of recipients to a single CSID.

With CSID, you can set up two basic types of automatic routing:

- If you are the only one in your organization who receives faxes from a specific fax machine (perhaps a supplier or a client who works only with you), your administrator could associate the client's CSID to your network or E-mail address. The fax software would then automatically route any faxes from this machine to you.
- You could also employ a more creative CSID routing method. The administrator could assign CSID strings to specific network addresses or to a group of addresses. When someone wants to send you a fax, you would tell them the CSID code to input. The sender then would change the CSID field (if sending via software) or reconfigure the hardware to transmit the proper CSID. The routing table would capture the designated string and send the fax directly to you or your workgroup. In effect, you would have your own routing code. This will work well as long as the sender knows how to change the CSID at his or her end.

Call Subscriber ID (CSID) routing associates the sender with a fixed E-mail address. Most fax machines transmit a CSID calling string.



QUARTERDECK

CLEANSWEEP 95™ FOR WINDOWS 95® WILL UNINSTALL ALL YOUR OBSOLETE PROGRAMS.

(LIKE, OH FOR INSTANCE, UNINSTALLER®.)

Sorry Uninstaller, but the new Quarterdeck® CleanSweep 95 just swept you under the carpet. While you may be excellent at uninstalling those bitty 16-bit programs, that skill won't get you very far in Windows 95.

Windows 95 is big, with big 32-bit programs. CleanSweep 95 is smart and powerful, with native 32-bit power to remove any program in the Windows 95 world – both 16- and 32-bit.

And it does it much faster than other (uh-hmmm) uninstallers, so you don't have to twiddle your thumbs for hours every time you uninstall something, archive it or go searching for leftover bits of unwanted files.

Quarterdeck CleanSweep 95 is also much safer to use than other uninstallers. Much easier, too. Wizards do most of the work for you – all that's left to do is simply click.

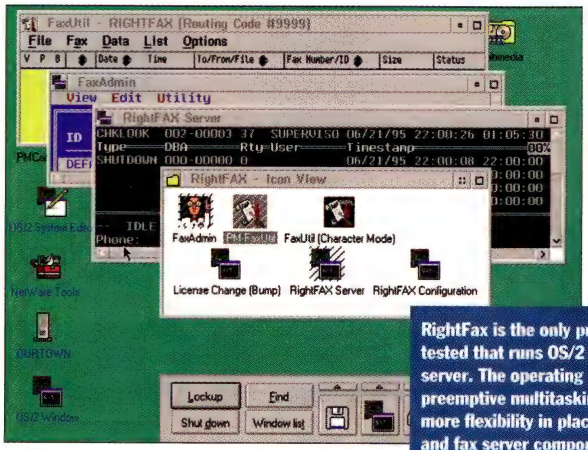
To see for yourself everything CleanSweep 95 can do, call 1-800-683-6696 for your free trial edition. Or you can download a copy from our website at www.qdeck.com.

Even better, pick up the real thing at your computer store. You'll get ten dollars off just for bringing in any old uninstaller.* Don't worry, we'll find a good home for it.

Circle 92 on Inquiry Card (RESELLERS: 93).

*Special competitive upgrade offer applies to registered users of Microhelp Uninstaller, Vertisoft Remove-It, Landmark Uninstall-It, IMSI Windelete, and, of course, Quarterdeck CleanSweep. Dealer prices may vary.

©1995 Quarterdeck Corporation. 150 Pico Boulevard, Santa Monica CA 90405. Quarterdeck is a registered trademark and Quarterdeck CleanSweep 95 is a trademark of Quarterdeck Corporation. All other trademarks are properties of their respective owners.



RightFax is the only product we tested that runs OS/2 on the server. The operating system's preemptive multitasking allows more flexibility in placing file and fax server components on different servers.

LanFax

In a roundup plagued by installation problems, Alcom's LanFax was the worst offender. Once you get past its sore spot, though, LanFax reveals a power and versatility that show why it remains a popular choice for industrial-strength applications.

LanFax requires 550K of conventional RAM, an unrealistic requirement in an environment where loading network drivers high can create other problems. We modified EMM386 parameters to include some memory areas recommended by the manual and ended up with 520K. We were then able to run the LanFax server program—that is, after hours of flipping through manuals; editing DOS configuration files; searching for, modifying, and creating special configuration files; second-guessing instructions; and so on.

To set up the client software, we had to load a runtime version of Borland's Paradox and use it to call .DB files that the installation program had not placed where the manual said they would be. We then were told to run a network communication TSR. Ultimately, we brought up LanFax's Windows client and were now quickly sending and receiving faxes. Notification of incoming faxes is clear and intuitive, with point-and-click access to a fax viewer.

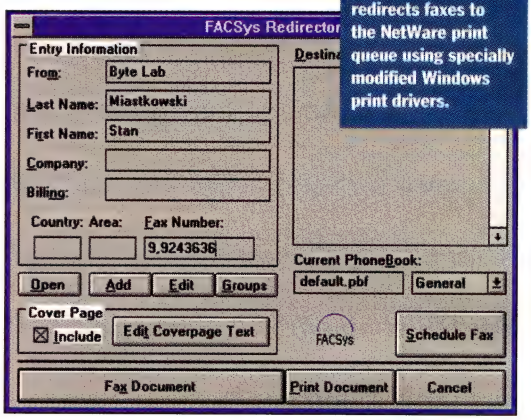
LanFax comes with an array of traffic-management, fax, and other communication features. It can work alongside other packages, such as Delrina's WinFax Pro and Cardiff's Teleform. Programmers will appreciate the API access to DOS/Windows libraries and Windows DLLs.

With a capacity of 8000 users and 32 lines per server, LanFax is built for large installations. It's a technically impressive product with a multitasking design that allows parallel task processing, and it has transport-layer support for network operating systems. But its size and complexity could scare off customers with somewhat less ambitious plans.

Net Satisfaxtion

Version 3.0 of Delrina's Net Satisfaxtion adds support for GammaLink GammaFax boards, though the program's 1000-user, eight-line capacity exposes its background as a midrange product. Delrina, which acquired the software from Intel after our testing was completed, plans to add its WinFax front end to the next major upgrade of Net Satisfaxtion.

Delrina's installation software and supporting documentation are the best of this group. The program guides you in the prop-



Optus's FACSys Redirector dialog box pops up over third-party applications. The program redirects faxes to the NetWare print queue using specially modified Windows print drivers.

Fax Routing: You Can't Get There from Here

Fax routing is a huge problem for fax vendors and for enterprises implementing network-based faxing. All fax server software offers at least the first three options listed below.

Manual in-bound routing is reliable but inconvenient. A person views incoming cover sheets and redirects the fax files using software. The drawback: labor intensive.

DTMF-based routing employs the beeps of Touch-Tone phones to transmit numbers that identify recipients. The software sets up dual-tone multifrequency (DTMF) aliases for client workstations. DTMF requires that senders know the recipient's code and can enter it from the fax machine touchpad.

Direct inward dialing (DID) requires a special trunk line that sends faxes directly to the correct recipient using the final four digits of a unique fax number. It is one of the most reliable methods but is expensive because of the extra lines and equipment.

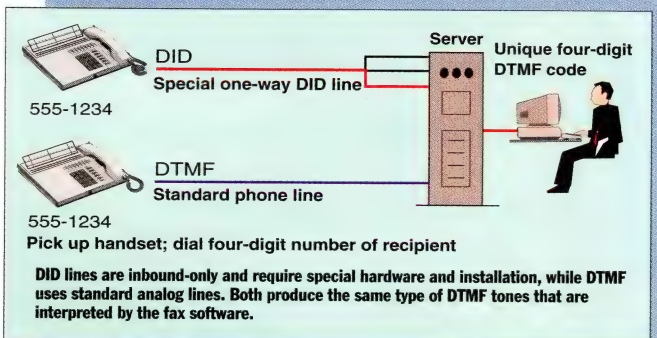
Call Subscriber ID (CSID) uses a string transmitted to the receiving station. A routing table associates the CSID with the proper network or E-mail address.

Line routing (or channel routing) is the simplest, most reliable, and usually most expensive approach. Requires a separate phone line for each recipient or workgroup.

OCR reads the recipient's name from the cover sheet and exports it to the server's user database. Matching the OCR engine's guesses against the database of network users can improve the odds.

T.30 subaddressing uses coding contained in the T.30 protocol for fax transmission. Potentially the best combination of affordability and reliability, T.30 has not been adopted widely yet.

These are the most popular routing methods. Vendors add their own. Delrina's Net Satisfaxtion, for example, lets you add the recipient's network user name.



DID lines are inbound-only and require special hardware and installation, while DTMF uses standard analog lines. Both produce the same type of DTMF tones that are interpreted by the fax software.

Network Faxing... The Next Generation

Marc Bisnaire & Andrea Quesnelle

With the recent release of Windows95 and of WindowsNT, network faxing is evolving, and with it emerges the next generation. So how to define the "next generation" of network fax products? Two main factors emerge: usability (including re-usability) and tighter integration, with both the network and the desktop.

User needs... user costs...

Training costs and usability are major considerations when selecting a network fax solution. How much time will it take to bring users up to speed? Will they use all of the available features? Start by selecting the right user interface - one that is well laid out and simple to follow, such as FAXport from LANSource Technologies. When seeing FAXport for the first time, most users are already "familiar" with how it works, as the user interface seems to neatly mesh the best of most every single-user fax software.

One Button Faxing. Since many users often forget to change the printer driver or simply don't know how to, faxing should be as easy as pressing ONE button. FAXport does this admirably, by including a FAXmenu button on screen that automatically selects the fax-printer driver without changing the default. This saves time and frustration.

Integration... Integration...

Next generation network faxing must be able to integrate and customize fax functionality into various desktop applications. Next generation network faxing products require OLE Automation, DDE, and a DLL API to provide all fax functions from send, to receive, to status updating. FAXport provides all three APIs. With over 140 OLE Automation functions available and using, say, Visual Basic as your scripting language, you can tightly integrate network faxing into various applications.

WinFax(TM) Compatibility. Like it or not, WinFax has a large market share, and many users have it installed on their PCs. Any network fax solution should also include the best features of this software, but more importantly, be able to read WinFax phonebooks, view WinFax images and even use WinFax DDE links. FAXport does exactly that only better; it's a true network FAX Server solution. With FAXport, a corporate solution has no holdouts, making it easier to administer.

UNC Support. With WindowsNT and Windows95 comes the need to support UNC (Universal Naming Convention), i.e.: the means by which to replace drive mappings with the actual location of the files. Think "\\Server\volume\filename" instead of "H:\Filename". This becomes very useful when you know where a file is but not on what drive.

ODBC Compliant Phonebooks. Next generation network faxing should allow use of almost any data source as a fax phonebook. That means ODBC! FAXport's ODBC Mapping program, allows you to MAP any ODBC database (datatable to the purest) to a FAXport phonebook. The three table design displays the FAXport phonebook format, a link column, and the ODBC table format. This ingenious design lets you drag & drop the data field into the link column to match the FAXport phonebook format.

More & more & more faxing

Bulk faxing is an increasingly necessary, albeit painful, marketing tool in many companies. A next generation fax product has to make this task accessible to all as easily as sending a single fax. The fax server should do all the work - generating individual cover pages, adding network attachments, sending at the optimum time, all with meaningful reporting. In this way, it increases sales potential and customer satisfaction. FAXport does exactly that. Users can send bulk faxes the same way they'd send a single fax; the only difference is that you select one or many phonebooks, instead of a single address, as the destination.

The next generation fax product must include an advanced Cover Page/Form Designer, that is OLE 2.0 enabled and capable of customizing faxes by inserting fax phonebook fields that the fax server can then read and fill. It must also allow you to add custom entry fields, related to a database of your choosing, in order to create the right form for faxing. FAXport's Cover/Form Page Designer provides all of these capabilities.

The 32 bit world

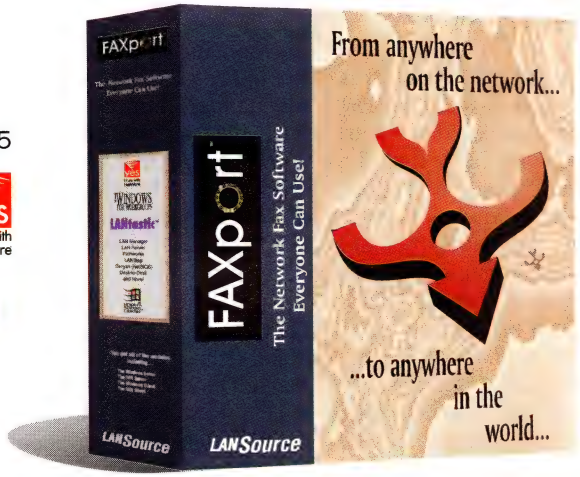
For the corporate network, reality has evolved into a 32 bit world, with WindowsNT and Windows95 at its centre. Ironically, not all fax softwares have a 32 bit version, let alone a 32 bit fax server that runs as a service on NT. FAXport, however, provides these, as well as a 32 bit client software for both Windows95 and WindowsNT, and even a great Windows version for those who choose to live in a 16 bit world a little longer.

Overall, next generation network fax software needs to integrate more with the changing reality both on the network and on the desktop. LANSource Technologies Inc.'s FAXport is an excellent example of a next generation product that addresses these factors effectively, at a very competitive price. A 5 user, 4 modem version starts at only U$399. ■

Andrea can be reached at andrea@lansource.com

Windows95 and WindowsNT are trademarks of Microsoft Corporation.
WinFax is a trademark of Delrina Corporation.

Microsoft Windows95
MICROSOFT WINDOWS COMPATIBLE
yes It runs with NetWare
Microsoft BackOffice



From anywhere on the network...
...to anywhere in the world...

Windows95?
WindowsNT?
Windows?

Yes!

a FAX server for the next generation...

1-800-677-2727, 1-416-535-3555, Fax 1-416-535-6225, sales@lansource.com

LANSource™

Copyright (c) 1995. LANSource Technologies Inc. All rights reserved. FAXport, WINport, and LANSource are trademarks of LANSource Technologies Inc. Other product names are trademarks of their respective companies. Developer tested only. Novell makes no warrantees with respect to this product.

Circle 121 on Inquiry Card.

FAX SERVER FEATURES COMPARED

	FACSYS	LANFAX	NET SATISFAXTION	OBJECTFAX	FAX RESOURCE	RIGHTFAX
ADMINISTRATION						
Event log is exportable	●	●	●	●	●	●
Fax board is software configurable	●	●	●	●	●	●
Supports passwords for inbound faxes	●	●	●	●	●	●
Has integrated billing module	●	●	●	○	○	●
FAX						
Major boards supported (B=Brooktrout, G=GammaFax, I=Intel, P=PureData)	B, G, I, P	G, I, P	G, I, P	B, G	G, I, P	B, G
Maximum number of users/lines	Unlimited/8	8000/32	1000/8	4096/32	Unlimited/160	Unlimited/24
Supports binary file transfer	●	●	●	○	○	●
NETWORK						
Networks supported	NetWare	NetWare, LAN Manager, LAN Server, LANtastic, Vines, etc.	NetWare	NetWare, LANtastic, Vines, Pathworks, etc.	NetWare, LAN Manager, LAN Server, LANtastic, NT, etc.	NetWare, LAN Server
Handles image conversion on server	●	●	●	○	●	●
Allows remote installation of client software	●	●	●	○	●	●
Client OSes	DOS, Windows	DOS, Windows	DOS, Windows	DOS, Windows	DOS, Windows	DOS, Windows, OS/2
ROUTING						
CSID	●	●	●	●	●	○
DID	●	●	●	●	●	●
DTMF	●	●	●	●	●	●
Line (channel)	●	●	○	●	●	●
OCR	●	○	●	●	○	●
T.30 subaddressing	●	●	○	●	○	○
SERVER						
Operating system	DOS	DOS	DOS	DOS	DOS/Windows	OS/2
Minimum CPU	286	386	386	286	20-MHz 486SX	386
Minimum RAM	2 MB	8 MB	3 MB	640 KB	4 MB	12 MB
Minimum hard disk capacity	—[1]	100 MB	40 MB	30 MB	80 MB	200MB
WORKGROUP						
Builds phone book from NetWare Bindery	●	●	○	○	○	●
Number of E-mail protocols supported	2	4	—[2]	3	4	4
Supports MAPI	○	●	○	●	●	●
Supports MHS	●	●	○	○	○	○
Supports VIM	●	●	○	●	●	●

Yes = ● No = ○
1 Faxes are stored on NetWare file server.
2 Available via third-party CAS gateways.

er order through all the required steps. The administrative module is straightforward and lets you establish user privileges by choosing names in a list imported from the NetWare Bindery.

While far less feature-rich than LanFax or RightFax, Net Satisfaxtion nonetheless has numerous features that mark it as a contender for mission-critical operations. It supports direct inward dialing (DID) (see the text box "Fax Routing: You Can't Get There from Here" on page 140), and it comes with billing options that are useful for setting up a fax-based line of business. Its unique drawback: minimal support for E-mail.

ObjectFax

ObjectFax, from Traffic Software, was one of the easiest programs to set up. The installation module for the server is a Windows program that copies all the files to a NetWare file server. (The fax server itself is a DOS application and does not run on the file server.) The installation program also sets up a Windows administrator program to configure the fax board and lines.

The client software includes an inbox toolbar; for administrators, the toolbar includes configuration buttons. Once we installed it on the client, we found that using ObjectFax is as simple as selecting the ObjectFax printer and printing. From a floating toolbar, you can call a simple text editor to fax a short note. You can even create standard attachments that are then available from the program's toolbar.

While ObjectFax directly supports only DOS and Windows clients, an API option allows the enterprising programmer to access the fax server from any platform connected to the file server.

RightFax

A full-fledged multitasking, multithreading native OS/2 application, RightFax is designed for serious high-volume faxing in medium-to-large organizations. That target market is most evident from its pricing:

PROFESSIONAL MONITOR SERIES

A BIGSHOT IS READY FOR NEW CHALLENGE

TÜV Rheinland GS geprüfte Sicherheit

Strahlungsarm MPR II low radiation
TÜV Rheinland Gruppe

DHHS

FCC BZT
CLASS B CLASS B

CSA UL

energy EPA POLLUTION PREVENTER

See Us At
COMDEX/Fall '95
November 13-17, 1995
Las Vegas, Nevada USA
Hall: Sanos Convention Center
Booth: S 4056

M1448

M1566

M1766

GVC Display Business Unit achieved a significant growth in 1994. In 1995, we will not only devote ourselves to extending capacity but also to developing a new generation of monitors. This year we will introduce our economical but high quality M1566 (15-inch) and M1766 (17-inch) models. Both of these monitors are digitally controlled by MCU, comply with EPA & VESA energy-saving standards, have R.G.B. color adjustment, and can be adjusted for both Pincushion and Rotation. GVC's FULL SCREEN performance expands your image by 10%. ON-SCREEN-DISPLAY is built in to M1766. Please inquire immediately, for further details.

GVC®
The Name You Can Trust

GVC CORPORATION
DISPLAY BUSINESS UNIT
8F, 80, Sec.2 An-Ho RD, Taipei, Taiwan, R.O.C.
Tel: 886-2-701-2226 Fax: 886-2-704-0338

Circle 535 on Inquiry Card (RESELLERS: 536.

Unleash your Pentium/Alpha!

Microway's NDP Fortran & C|C++ are the only 32-bit compilers which take full advantage of the Pentium and Alpha's dual numerics units. They run on **DOS, UNIX, OS/2, NT** and **OS/F**. To get **RISC** numeric performance from a **Pentium** or **Alpha** you need to schedule your code and use Superscalar optimizations. In his Jan. '95 Dr. Dobbs article, S. Fried describes how to get 35 megaflops from a Pentium using NDP Fortran. The Alpha version of NDP Fortran hits 88 megaflops running on OS/F or NT systems or on DOS using Microway's new ISA add in card. Put our compilers or Pentium, i860 and Alpha systems to work for you today. Call for white papers on Pentium, i860, or Alpha Code Generation, OS/2 or our Pentium FDIV fix, now!

i860/Pentium/Alpha SuperComputers

BX Series Pentium/Alpha/i860 Workstations - Microway's workstations and industrial PC's come configured with DOS, OS/2, UNIX, From....$2195

Gigacube® Three to six QuadPuters - Up to 24 i860's for $50K! Computational Server runs NFS.

NumberSmasher®-860 Up to 80 megaflops, does 1024 FFT in just .9 ms, From.....$2995

QuadPuter®-860 Four 40 MHz i860's plus shared memory equals 320 megaflops.....$11995

ArrayPRO/XP™ - 100/200 megaflops, 400 MB/Sec memory, 80 and 33 MB/Sec DSP Interfaces.... $8995

NumberSmasher®Alpha 100+ megaflops - this ISA Superscalar add in card runs on DOS or UNIX. It uses T8 links for parallel processing. From $5995

NDP Compilers

Microway's family of 32-bit compilers run on **DOS, OS/2, NT, UNIX,** and **OS/F** generating code for the Intel 386, 486, Pentium, i860 and DEC Alpha.

NDP Fortran™ is a full F77 with complete VMS, F66, DOD, and MS extensions.

NDP C|C++™ runs in K&R, ANSI and C++ modes and generates the highest quality numeric code of any 32-bit C compiler.

NDP Pascal™ is a full ISO Level 0 translator.

DOS releases includes VCPI, DPMI, NDPLink, VM, NDPLib and GREX-Microway's bit mapped graphics library. The 486/Pentium version adds 486/Pentium code generation, Clearview, the MGX vector graphics library, and DPMI DOS Box support for demand paging and GREX.

386 Version 4.41.....$695
Pentium/486 Version 4.5.....$995

OS/2 releases use IBM Tools, take advantage of the IBM WorkFrame and include MGX

386.....$595
486/Pentium.....$895

Alpha NDP compilers start at.....$795

Call for **UNIX, OS/F** and **NT** pricing.

NDP Fortran 90 extensions to NDP Fortran...$295

Microway®

Research Park, Kingston, MA 02364 USA
(508) 746-7341 FAX (508) 746-4678
Call for Germany, India, Indonesia, Israel, Japan, Poland, Russia and U.K.

REVIEWS Software Roundup

Product Information

FACSys 3.40a $995
multiple file server version $2995
Optus Software
Somerset, NJ
(908) 271-9568
fax: (908) 271-1044
sales@optus.mhs.compuserve.com
Circle 1152 on Inquiry Card.

Fax Resource
two-channel/250-user version . . . $1295
two additional channels $495
Resource Partners Inc.
Wakefield, NH
(603) 522-9500
fax: (603) 522-9747
Circle 1153 on Inquiry Card.

LanFax 2.15aGL
25-user version $1995
50-user version $2995
Alcom Corp.
Mountain View, CA
(800) 801-8000
(415) 694-7000
fax: (415) 694-7070
sales@alcom.com
Circle 1154 on Inquiry Card.

Net Satisfaxtion 3.0
25-user version $1195
1000-user version $1995
Delrina
San Jose, CA
(800) 268-6082
(408) 363-2345
http://www.delrina.com
Circle 1155 on Inquiry Card.

ObjectFax 3.5
25-user license $1595
Traffic USA Inc.
Boca Raton, FL
(407) 995-5282
fax: (407) 995-5272
Circle 1156 on Inquiry Card.

RightFax 4.0
single channel, unlimited users $995
each additional channel $795
RightFax
Tucson, AZ
(520) 327-1357
fax: (520) 321-7456
fax on demand: (520) 327-1288
sales@rightfax.com
Circle 1157 on Inquiry Card.

$995 buys you a very basic one-telephone-line license. Each additional line costs $795. It can add up quickly. For example, a four-line RightFax installation with OCR and E-mail support costs $5970, and that's not counting hardware.

Because of OS/2's true preemptive multitasking, you can install RightFax along with an OS/2 NetWare server, E-mail or voicemail server, or put all of them on the same system. You can also install RightFax in a file server configuration (whether on the same or different hardware as your NetWare). A file server installation supports fax annotation, which isn't available with a dedicated fax server. However, resource and performance issues make a dedicated fax server the best bet for all but the smallest installations.

RightFax posed another difficult installation. You need the latest version of the NetWare Requester for OS/2. Even if you already have it, you'll probably need to reinstall it to make sure it's set for Global NetWare Shell Support and both client and server support. But that's just the beginning. You also must have NetWare Administrator privileges. And you need to fiddle with both SYSCON and PCONSOLE before installing the RightFax software, setting up a RightFax user account and establishing a print queue. Unlike FACSys and Net Satisfaxtion, RightFax doesn't do a quick basic installation that you can dink with later.

Installing the client is simple. In Windows, RightFax has the handy PowerBar (see the screen on page 140). This is a floating and customizable icon bar that gives you quick access to a phone book, in/out box, and a utility for almost-instant faxing. The PowerBar has icons to instantly switch between your default printer and the RightFax queue. You can also drag and drop document icons onto the fax icon in the PowerBar.

RightFax has extensive support for use of billing codes. You can even prevent people from sending faxes unless billing codes are entered.

Playing Favorites

When we judge all six programs by our general criteria of user friendliness and upward scalability, Optus' FACSys pulls ahead of the pack. Its rich hardware compatibility, ease of use, and tight integration make it a comfortable fit for most applications. FACSys appears to do the best job of accommodating both mid-range network faxing and high-end, mission-critical applications. Adding cards and servers lets FACSys scale up as demand grows. FACSys works only with NetWare, but a Windows NT version provides wider network compatibility.

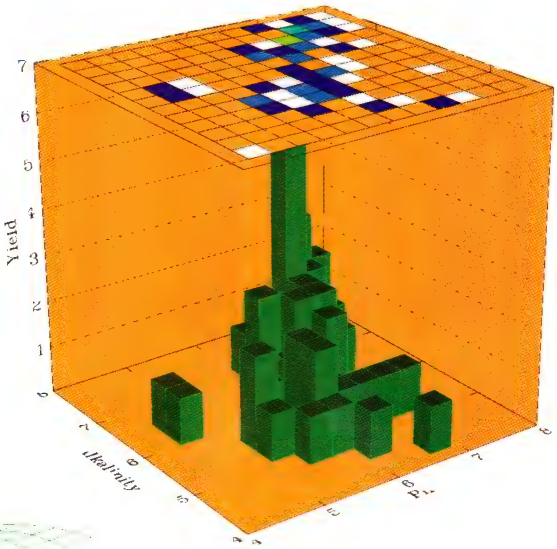
Following a close second is Traffic Software's ObjectFax. It sports the best-looking client interface, a fairly advanced object orientation to faxing, and an API that we may use someday to provide interoperability with our Macintosh clients. ■

Rex Baldazo and David Essex are BYTE technical editors. Stan Miastkowski is a consulting editor. You can reach them on the Internet at rbaldazo@bix.com, dessex@bix.com, and stanm@bix.com.

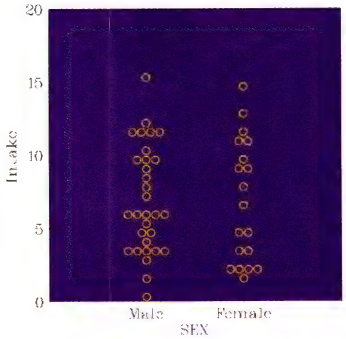
FAST, FLEXIBLE STATISTICS & GRAPHICS FOR SERIOUS SCIENTISTS

Biologists • Environmental Researchers • Medical Researchers • Psychologists • Statisticans

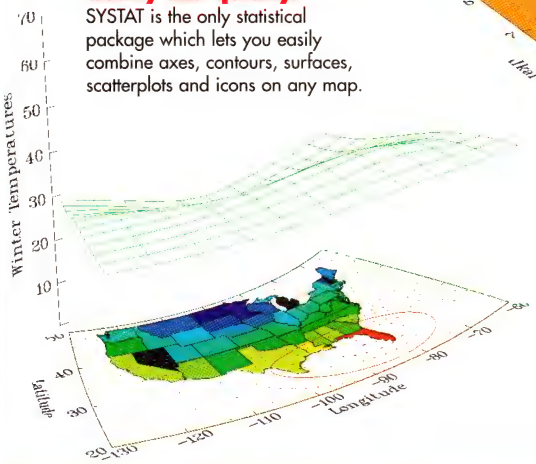
Discover hidden patterns in your data easily.
With SYSTAT, it's easy to overlay, combine charts and to simply rotate even the most complex 3-D plots with the press of a button.



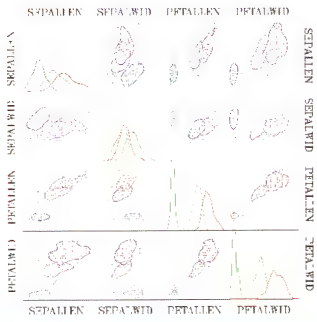
Display your raw medical data in a simple, easy-to-understand format.
SYSTAT is the first statistical package to offer automatic dot plots.



Display geographic data clearly and quickly.
SYSTAT is the only statistical package which lets you easily combine axes, contours, surfaces, scatterplots and icons on any map.



Get a clear picture of your multivariate data faster.
SYSTAT is the only package which can combine kernel density, contours and other graphical objects inside scatterplot matrices.

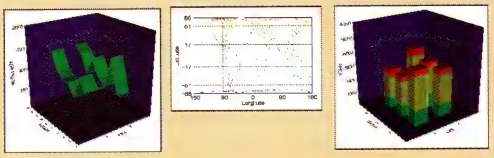


YOU CAN RELY ON SYSTAT FROM DATA TO DISCOVERY

"...nearly every kind of statistical analysis imaginable, and its graphics capability is far and away the best of any PC statistical package." – *InfoWorld*

"...the most flexible program for graphical representation of numeric data...and it has the most comprehensive procedures for data exploration." – *MacUser*

"...the best software for analysis of designed experiments...superb graphics, high quality statistical algorithms..." – *PC Magazine*



Comprehensive statistics for all types of scientific data
- A full range of powerful statistics
- Work with an unlimited number of variables
- Robust algorithms give precise, accurate results even when your data are extreme
- Most powerful GLM procedure
- Design of experiment procedures include Taguchi, Plackette-Borman, Box-Behnken, Latin Squares and mixture models
- Extensive matrix procedures for finding inverse, Cholesky decomposition and many others

The most graphics
- More graph types than any other statistical package – even more than Sigma Plot, Delta Graph and Harvard Graphics combined
- Extensive, high-precision world maps
- Flexible, easy-to-control object-oriented graphics
- Interactive graphical transformations tools to explore data
- Fast problem-solving capabilities, including Quick Buttons, Quick Graphs and a powerful internal calculator
- Object-oriented graphics to easily edit all aspects of your graphs and charts
- Extensive graphical tools for exploring your data in real-time, including 3-D rotation of graphs, color and grayscale fill defaults and rescaling

Extensive programmability and flexibility
- Choose command line or easy-to-use menus
- Handles all steps in analysis – data analysis, screening, intermediate, graphic presentation

INFO WORLD BEST IN ITS CLASS

CORPORATE TOP RATED PCWEEK 1990 SATISFACTION POLL

PC MAGAZINE EDITORS' CHOICE

SYSTAT is available for DOS, Windows and the Macintosh. For more information, contact SPSS Inc. at

1 (800) 543-5835
(312) 329-2400
fax 1 (800) 841-0064

SYSTAT

SYSTAT is a product of SPSS Inc.

Athens • Bologna • Chertsey • Chicago • Gorinchem • Herzila • Madrid • Munich • New Delhi • Paris • Singapore • Stockholm • Sydney • Tokyo • Washington, DC • And distributors worldwide

A5835

Circle 101 on Inquiry Card.

HANDS-ON TESTING

11 ULTRAPORTABLES GO THE DISTANCE

On the road again? These portables weigh in at about 6 pounds and offer near-desktop-level performance, great displays, large hard drives, and loads of useful features.

ANTHONY J. LENNON AND JOHN MCDONOUGH

They say the universe is expanding, but hardened road warriors know better: Time and space seem to converge when you're working in cramped quarters while in transit. With this in mind, we tested 11 ultraportables that provide near-desktop performance while you're in the back seat of a cab or flying above the clouds. These ultraportables may be petite machines, but they don't suffer from the features-deprivation complex that afflicted their subnotebook predecessors. Some of the systems we tested are resplendent with color active-matrix displays, zippy Pentium CPUs, and hard drives with over 500 MB.

Ultraportables have their drawbacks (e.g., most require external floppy drives), but they are catching up to heavier notebooks in terms of functionality. Battery life is getting longer (3½ hours on average; Hewlett-Packard's OmniBook 600CT lasted an incredible 5 hours and 46 minutes in the Thumper II tests), as many vendors migrate from nicad batteries to nickel-metal-hydride (NiMH) and lithium-ion batteries.

The majority of these ultraportables house Intel's SL-enhanced 486DX4 processor (either 75 or 100 MHz), and four of them have active-matrix displays. As a rule of thumb, expect to spend at least $700 more for a system that has an active-matrix

How to use this guide

We selected the best ultraportables by evaluating their price, speed, screen quality, battery life, features, and ease of use.

See the Roll Call on pages 164–165 for features included at this price.

A combination of the weighted scores for performance, screen quality, features, battery life, and usability.

A subjective assessment of the keyboard layout and feel, pointing device, status lights, and other considerations.

Based on BYTE's Thumper II battery run-down test.

This rates the display's crispness, intensity and color range, and range of viewing angles.

Digital HiNote Ultra CT475

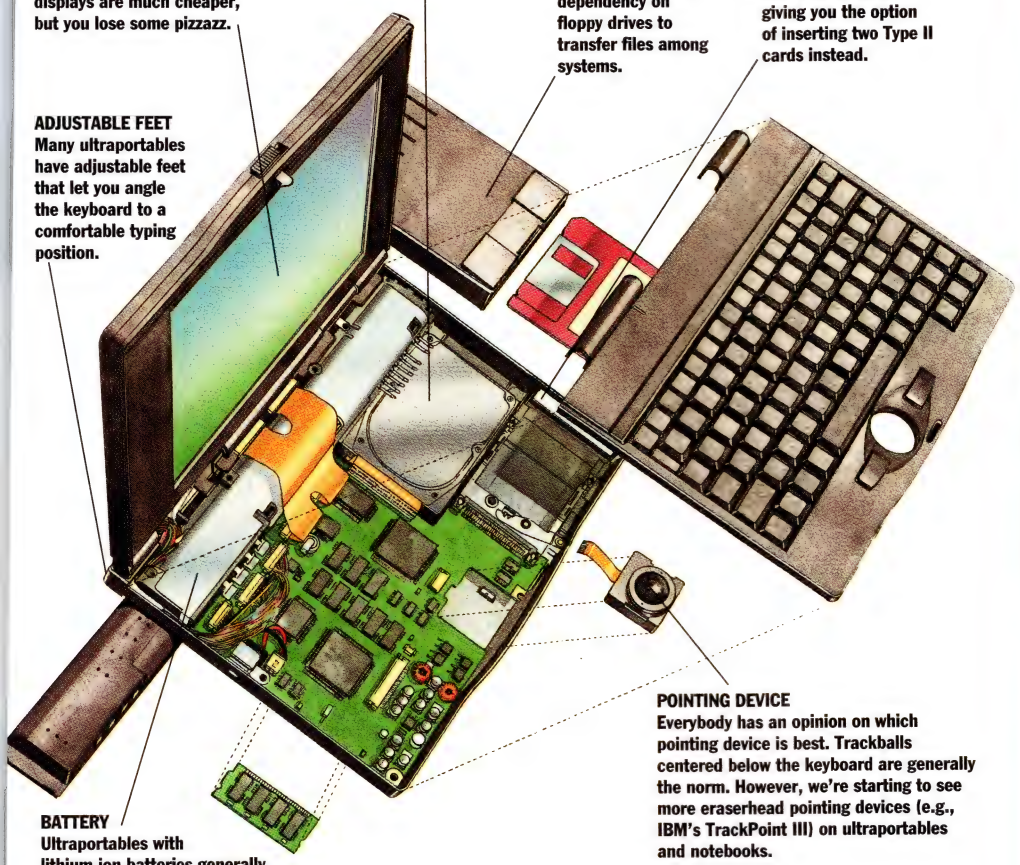
At 5.6 pounds with all its accessories, the HiNote Ultra CT475's 9½-inch active-matrix LCD gets the highest screen rating with deep yellows and dark blacks in our color-bar tests. Testers liked its unique trackball design (see "Honorable Mentions" on page 161) and the upright status LCD located to the right of the screen instead of below it. The HiNote's lithium-ion battery pack (4 hours and 40 minutes—second best overall) conveniently clips on the rear of the system, and Digital's optional Mobile Media Module ($899) turns the HiNote into a multimedia notebook. Its only drawback is a $4999 price tag.

	PRICE AS TESTED	CPU/SPEED	OVERALL SCORE	FEATURES	EASE OF USE	SCREEN QUALITY	BATTERY LIFE (HR:MIN:SEC)
DEC HiNote Ultra CT475	$4999	486DX4/75	▲▲▲	▲▲▲	▲▲▲	▲▲▲▲	4:39:55
Gateway 2000 Liberty DX4-100 DL	$4499	486DX4/100	▲▲▲	▲▲▲	▲▲▲	▲	4:15:12
HP OmniBook 600CT	$3999	486DX4/75	▲▲▲	▲▲	▲▲▲	▲▲▲	5:46:10
Zeos Meridian 400A	$3495	486DX4/100	▲▲▲	▲▲▲	▲▲▲	▲▲▲▲	2:29:49
IBM ThinkPad 701C	$4599	486DX4/75	▲▲	▲▲▲	▲▲▲	▲▲▲	2:08:32

Key: Ratings from 1 to 4: ▲ is the lowest; ▲▲▲▲ is the highest.

PHOTOGRAPHY: STEVE BELKOWITZ © 1995

Lightweights with a Punch



OCTOBER 1995 BYTE BEST ULTRAPORTABLES **BEST**

BEST HIGH-END ULTRAPORTABLE

Digital Equipment HiNote Ultra CT475

If you've got the money ($4999), Digital's HiNote Ultra CT475 is the perfect travel companion. Its 9½-inch active-matrix display produces vibrant, fully saturated colors—the best in our screen-quality tests. This ultraportable with a 75-MHz 486DX4 has a lithium-ion battery pack that powers it for over 4½ hours in our Thumper II battery run-down test. The system has 16-bit sound and supports an optional multimedia module for business presentations.
PAGE 148

BEST LOWER-COST ULTRAPORTABLE

AT&T Globalyst 130

This ultraportable looks more like a notebook system with its integrated floppy drive and 10.4-inch, passive-matrix LCD. It didn't do well in our performance benchmarks, but it lasted about 4 hours in the Thumper II test. The Globalyst has easy-to-read status indicators, a wide viewing angle, a large trackball, and an expansive wrist rest. Its $2223 price won't give you sticker shock.
PAGE 150

display than one with a dual-scan display. Active-matrix displays usually give you a wider viewing angle and fill the screen with brighter colors.

Constrained by such a small form factor, vendors have come up with some unique designs. The keyboard of IBM's ThinkPad 701C literally jumps out at you, the mouse on HP's OmniBook pops out the side, and several systems have infrared ports that let you transfer files with your desktop system, sans serial cables.

These innovations don't come cheap, however. The average price of an active-matrix ultraportable in this report is $4273. The Compaq Contura Aero 4/33C Model 250 and the Sceptre Technologies TS37 Subnotebook dip below $2000, but they don't have as many features as the higher-end systems.

Because vendors had difficulty squeezing their systems through our tight testing criteria, we reviewed fewer machines than normal. To be included, an ultraportable had to weigh 5 pounds or less without accessories or about 6 pounds with accessories (e.g., an AC adapter, a floppy drive, a battery, and so on). It had to have at least a 25-MHz 486SX CPU, 8 MB of RAM, a 200-MB hard drive, a color display, a 3½-inch floppy drive, and an integrated pointing device.

We divided the systems into two categories: high-end ultraportables priced above $3000 and the lower-cost alternatives. Our performance tests use Windows and DOS applications, such as Word, Excel, WordPerfect, and FoxPro, that measure how fast these featherweights are in real-world situations. The low-level InterMark suite tests stress system components, such as graphics and storage subsystem components under Windows.

ILLUSTRATION: BRUCE SANDERS © 1995

High-End Ultraportables

We tested five high-end ultraportables that should reduce a road warrior's fears about taking to the streets. These systems cost you dearly at $3495 or higher, but they all feature 486DX4 processors, and all but the Gateway 2000 Liberty DX4-100 Deluxe have active-matrix displays.

What Gateway's Liberty lacks in screen quality, however, it makes up for in performance by surpassing all the others in our high-level InterMark benchmarks. The Liberty is truly built for speed, with 24 MB of RAM and a 100-MHz 486DX4 processor. It is also the only one with 256 KB of secondary cache memory. The Zeos Meridian 400A also has a 100-MHz 486DX4 and draws bit-mapped Windows images faster than the Liberty does.

The Liberty has an expansive, 10.4-inch dual-scan LCD that surprisingly scored lower than many passive-matrix displays in our screen-quality tests. Testers believed that its colors were somewhat washed out in our color-bar test. The remaining high-end ultraportables did much better in the screen-quality tests, thanks to their active-matrix LCDs.

Clockwise from lower right: IBM's ThinkPad, Digital's HiNote, Zeos's Meridian 400A, Gateway's Liberty, and HP's OmniBook display NSTL's color-bar test.

We were also impressed with the unique designs of the ultraportables. IBM's ThinkPad 701C, which was held back by its short battery life (2 hours and 9 minutes), has a TrackWrite keyboard (known as Butterfly) that slides out and extends over the edges of the chassis. The 85-key keyboard is surprisingly firm to the touch. Our winner in this category, the slick-looking Digital Equipment HiNote Ultra CT475, features a Floppy Dock, which houses a 3½-inch floppy drive and connects underneath the HiNote; it angles the keyboard, increasing typing comfort. Also, the HiNote, the ThinkPad 701C, and the Hewlett-Packard OmniBook 600CT have built-in sound with high-quality speakers, and the latter two have built-in microphones.

OCTOBER 1995 BYTE BEST HIGH-END ULTRAPORTABLES

Digital HiNote Ultra CT475

At 5.6 pounds with all its accessories, the HiNote Ultra CT475's 9½-inch active-matrix LCD gets the highest screen rating with deep yellows and dark blacks in our color-bar tests. Testers liked its unique trackball design (see "Honorable Mentions" on page 161) and the upright status LCD located to the right of the screen instead of below it. The HiNote's lithium-ion battery pack (4 hours and 40 minutes—second best overall) conveniently clips on the rear of the system, and Digital's optional Mobile Media Module ($899) turns the HiNote into a multimedia notebook. Its only drawback is a $4999 price tag.

	PRICE AS TESTED	CPU/SPEED	OVERALL SCORE	FEATURES	EASE OF USE	SCREEN QUALITY	BATTERY LIFE (HR:MIN:SEC)
DEC HiNote Ultra CT475	$4999	486DX4/75	▲▲▲	▲▲▲	▲▲▲	▲▲▲▲	4:39:55
Gateway 2000 Liberty DX4-100 DL	$4499	486DX4/100	▲▲▲	▲▲▲	▲▲▲	▲	4:15:12
HP OmniBook 600CT	$3999	486DX4/75	▲▲▲	▲▲	▲▲▲	▲▲▲	5:46:10
Zeos Meridian 400A	$3495	486DX4/100	▲▲▲	▲▲▲	▲▲▲	▲▲▲▲	2:29:49
IBM ThinkPad 701C	$4599	486DX4/75	▲▲	▲▲▲	▲▲▲	▲▲▲	2:08:32

Key: Ratings from 1 to 4: ▲ is the lowest; ▲▲▲▲ is the highest.

THE INCREDIBLE SHRINKING PENTIUM

Toshiba's Portégé 610CT.

A laptop can never be too fast nor weigh too little. Toshiba America Information Systems (Irvine, CA, (714) 583-3000) has applied both these lessons well in designing the Portégé 610CT.

Like the Dell Latitude XPi P90T (see "Impressive Battery Life in a Laptop Pentium PC," September BYTE, page 286), the Portégé 610CT uses Intel's low-power Pentium clocked at 90 MHz. The 610CT uses extended data out (EDO) RAM, which, in certain circumstances, can improve performance. However, on our BYTEmark native-mode tests (see the chart), the scores were just about on par for a normally aspirated 90-MHz Pentium. That's not to say the extra expense of EDO RAM is wasted, but our low-level tests did not show a noticeable speedup.

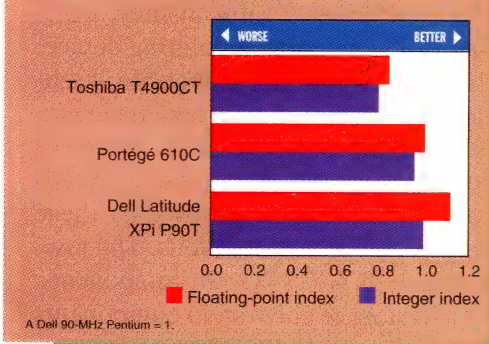
The benefit of a low-power microprocessor was readily apparent in our Thumper II word processing battery-life test. The smaller 610CT bested its big brother, the T4900CT (4 hours and 25 minutes), running 5 hours unplugged.

Many of the pieces in the 610CT seem familiar—almost ordinary: built-in 16-bit sound and a 9½-inch color thin-film transistor (TFT) display. But this computer is more than the sum of its parts. Somehow, Toshiba has managed to put the equivalent of a full-featured desktop Pentium into an elegant package that weighs under 5 pounds.

This achievement is not without some sacrifices. The floppy drive is an external unit, as is the AC power brick. But the biggest drawback is the tiny keyboard. IBM's magnificent Butterfly keyboard (see "Incredible Expanding Keyboard," May BYTE) has simply set the bar higher, and the Portégé 610CT does not rise to the challenge. A cramped keyboard used to be a trade-off we would accept to gain better portability. Now that someone has shown the world a better way, anything else seems like a step back.

Toshiba has once again delivered an amazing amount of power in a small form factor. Now if the company can just convince IBM to license the Butterfly keyboard, this could be the perfect traveling companion for the mobile professional. —Rex Baldazo

Pentium Performance



A Dell 90-MHz Pentium = 1.

Product Information

Portégé 610CT
8 MB of RAM, 686-MB hard drive $4649
Toshiba America Information Systems, Inc.
Irvine, CA
(800) 334-3445
(714) 583-3000
Circle 1247 on Inquiry Card.

It's the 2 in 1 rewritable optical disk and CD-ROM drive.

It's PowerDrive² from Panasonic.

It's the new standard of multimedia storage.

If you're thinking about buying a ***backup*** storage device, think ***twice.*** PowerDrive² gives you ***both*** a rewritable optical disk and ***CD-ROM*** in one drive. It even reads and writes like a hard drive. If you're thinking CD-ROM capabilities, think 2X. And ***4X.*** PowerDrive² reads both existing *and* emerging titles. If you're thinking compatibility options, PowerDrive² gives you ***two*** of those as well. Its internal or external drive easily connects to any PC or Mac. PowerDrive² from Panasonic. **It will change the way you look at multimedia storage, forever.** For more information on the new Panasonic PowerDrive², call 1-800-742-8086, and ask for ext. PD.

Panasonic
Communications & Systems Company

PD-BY

All other brand and company/product names are trademarks or registered trademarks of their respective companies.

Circle 84 on Inquiry Card.

Lower-Cost Alternatives

The lower-cost ultraportables we tested averaged $2100 less than the high-end ultraportables. Four of the systems carry passive-matrix displays, and the other two use dual-scan LCDs. Passive-matrix displays cost less and consume less power than active-matrix displays, but the trade-off is inferior color, lower contrast, and slower video response. Some of the lower-cost ultraportables, however, surprised us when we ran our screen-quality tests.

The AT&T Globalyst 130 offers the widest viewing angle and plenty of real estate on its 10.4-inch passive-matrix display as measured by NSTL's Heads-Up Range Device (HURD), which determines an ultraportable's maximum viewing angle from left to right and by tilting the screen backward. Both Austin Direct 486 StepLite Notebook models feature 9½-inch passive-matrix LCDs with wide viewing angles, which produced strong color scores. The least expensive models, Compaq's Contura Aero 4/33C Model 250 ($1199) and Sceptre Technologies' TS37 Subnotebook ($1695), however, did poorly on the color tests. Also, the Contura Aero's 7.8-inch passive-matrix LCD maxes out at 16 colors.

AT&T Globalyst 130.

At $2795, the Zeos Meridian 400C costs more than the other ultraportables in this category, but its 100-MHz 486DX4 processor powers it to the third-best performance scores of all the products. You pay a price for the speed, however; life gets sucked out of the Meridian 400C's nickel-metal-hydride (NiMH) battery (2 hours and 30 minutes) much faster than the other lower-cost ultraportables (which averaged 3 hours and 36 minutes). At the other end of the performance spectrum are the Sceptre TS37 Subnotebook and the Contura Aero, which use 33-MHz 486SX processors. They dragged through our performance benchmarks but had longer battery lives than that of the Meridian 400C.

The AT&T Globalyst 130, TS37 Subnotebook, Contura Aero, and the two Austin models have trackballs of assorted sizes and placement, while the Meridian 400C has an eraserhead to the right of the handrest with left- and right-click buttons on the front of the chassis. This makes it easy to click with your thumb while keeping a finger on the eraserhead. When it comes to trackballs, we find the bigger, the better.

AT&T Globalyst 130

The AT&T Globalyst 130 looks more like a traditional notebook than an ultraportable with its integrated floppy drive and wide, 10.4-inch passive-matrix display. Nevertheless, the $2223 ultraportable weighs only 6.1 pounds with all its accessories. AT&T picked its components carefully to make sure its system was affordable, with enough features to satisfy any traveling businessperson. Its long-lasting NiMH battery (3 hours and 52 minutes), 340-MB hard drive, and 75-MHz 486DX4 processor give it respectable performance for road work.

	PRICE AS TESTED	CPU/SPEED	OVERALL SCORE	FEATURES	EASE OF USE	SCREEN QUALITY	BATTERY LIFE (HR:MIN:SEC)
AT&T Globalyst 130	$2223	486DX4/75	▲▲	▲▲▲	▲▲▲	▲▲▲	3:52:28
Zeos Meridian 400C	$2795	486DX4/100	▲▲	▲▲▲	▲▲▲	▲▲	2:20:39
Austin Direct 486 StepLite	$2407	486DX4/75	▲▲	▲▲▲	▲▲▲	▲▲	3:18:33
Austin Direct 486 StepLite	$2065	486DX4/50	▲▲	▲▲▲	▲▲▲	▲▲▲	2:52:15
Sceptre TS37 Subnotebook	$1695	486DX/33	▲▲	▲▲	▲▲▲	▲	3:31:48

Key: Ratings from 1 to 4: ▲ is the lowest; ▲▲▲▲ is the highest.

TOUCHPADS TO NAVIGATE BY

An individual's taste in pointing devices, like music and art, is highly subjective. Some of us love IBM's TrackPoint device, while some can't quite get the hang of it. Touchpads, too, claim devotees and naysayers, but the technology has made some notable advances over the last few years.

The first widely available touchpad for portables is Alps Electric's (San Jose, CA, (800) 825-2577) GlidePoint (see "Do the Electric Glide," April BYTE, page 203), which uses field-distortion sensing, a capacitance-sensing technology licensed from Cirque (Salt Lake City, UT). The two layers of electrical conductors, arranged in a grid, generate an electrical field over the GlidePoint's surface. Your fingertip distorts the field, and the GlidePoint determines the exact location of your fingertip by sensing the strength of the distortion at each conductor.

For comparison purposes, we tried the Cirque technology on a Sharp PC-8900 that comes standard with a GlidePoint. It takes some getting used to, especially the tapping motions required to trigger mouse-clicks, double-clicks, and click and drag. But once you get a feel for it, the GlidePoint is a natural way to navigate a cursor around the screen. You run into trouble, however, when you're dragging an item and your finger runs into the edge of the pad. With the GlidePoint driver, you can configure the right mouse button to act as a drag-lock key, but that's not the best solution.

An even better answer is the Synaptics (San Jose, CA, (408) 434-0110) TouchPad. The TouchPad also takes advantage of capacitance-sensing technology, but the company has extended the pad's capabilities with proprietary algorithms for pattern recognition and adaptive analog VLSI technology. Not only does the TouchPad sense motion of any kind, it also senses pressure or even the distance of your fingertip from the pad's surface. Although not yet enabled through the current driver, this technology will support pressure-based functions such as handwriting, painting, and other applications that usually require a pressure-sensitive graphics tablet.

The Synaptics TouchPad (left) and the Alps GlidePoint.

To deal with the limitations of dragging, the TouchPad supports Edge Motion. When your finger reaches the edge of the pad's surface, the cursor continues to move in the indicated direction as you apply pressure to the edge of the pad. We used the Synaptics TouchPad on an Epson ActionNote (Torrance, CA, (800) 374-7300), and everything worked as advertised. Edge Motion removed one of the last major complaints about using touchpad technology and made the TouchPad a better choice than the GlidePoint. Your choice of pointing devices is still a personal decision, but touchpad technology just keeps getting better.

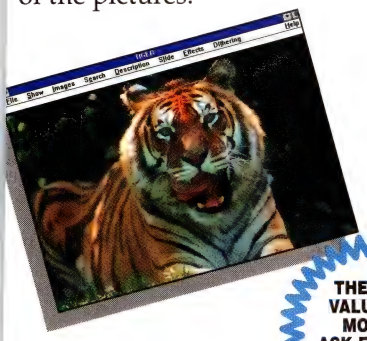
—Stanford Diehl

Don't just settle for collections of pictures!

TRAVEL NOTES ON CD

TRAVEL NOTES ON CD is an ambitious project, the result of intensive research work, which will take you on a voyage of rediscovery of our planet, nature and the peoples who formed it over the conturies.

TRAVEL NOTES ON CD is an extensive library, with more than 100 exclusive photographs by well known photographers on each CD-ROM, presented by means of a sophisticated WINDOWS PROGRAM which permits personalized selection of the pictures.



THE BEST VALUE FOR MONEY! ASK FOR OUR PRICE LIST.

Each photograph is accompanied by a full caption, both in writing and sound; various zoom and colour modification effects are available and the pictures can be printed and, if desired, exported to the most common formats (BMP, TIFF, PCX, JPG, GIF).

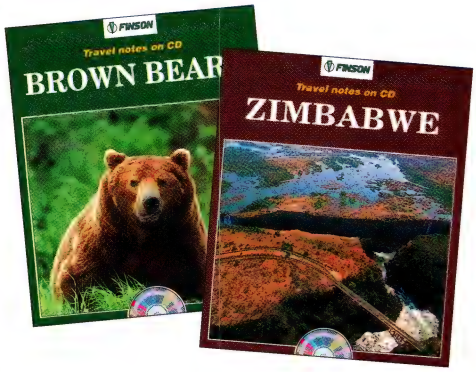
It is also possible to active a "SLIDE" function which guides us on our personalized journey.

Configuration required: Windows 3.1 or higher, CPU 386 or higher, 4 megabytes of RAM, VGA graphic card.
The pictures contained in the CD are in 640*480 format with 16 million colours.

Recommended: SVGA graphic card, 1 megabyte of RAM, compatible Sound Blaster card.

Ask for our full catalogue!

Already available: ZIMBABWE, POLAR BEARS, BROWN BEARS, SOUTH AFRICA, EGYPT, AFRICAN FELINES, GREAT AFRICAN HERBIVORES, ANIMALS OF INDIA, NAMIBIA, MALAWI, FRENCH POLYNESIA, NEW ZELAND, GREATER ANTILLES, ORCHIDS.
Coming out soon: PARKS OF AFRICA, MAURITANIA AND SENEGAL, KENYA, ZAIRE, TANZANIA, MOROCCO, DOGS, CATS.



WINDOWS is a registered trademark of the Microsoft Corporation

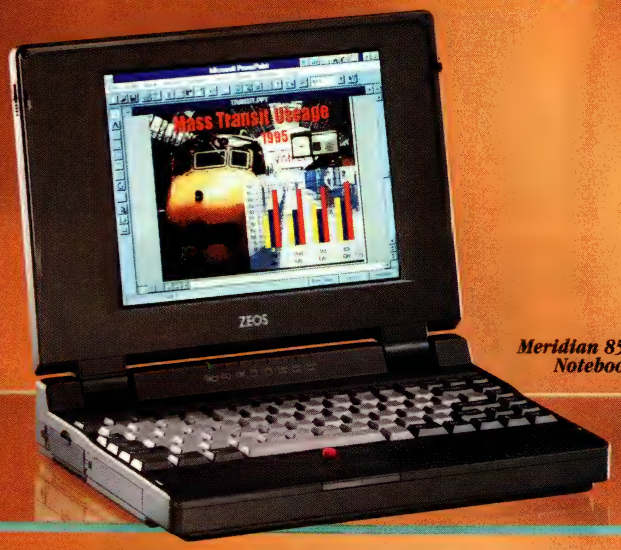
INTERNATIONAL DISTRIBUTORS WELCOME!

FINSON

FINSON srl - Via Montepulciano, 15 - 20124 Milano (ITALY)
Tel. +39-2-66987036 - Fax +39-2-66987027
INTERNET: MC8468@MCLINK.IT - FINSON.SRL@AGORA.STM.IT

Circle 529 on Inquiry Card (RESELLERS: 530).

ZEOS® Meridian™ Notebooks...



Meridian 850 Notebook

Meridian 400 Subnotebook

Meridian 800 Notebook

Meridians with unretouched photos of active matrix displays.

Go To The Head Of The Class.

ZEOS Meridian notebooks are the classiest acts in town, each the leader in its category, ready to give you the power, performance and mobility that you could only dream of until now!

While each Meridian product is distinct, they all have several intelligent features that set them apart including local bus video; an 84-key keyboard with a comfortable palm rest and integrated TruePoint™ pointing device; and the most solid construction available so that you won't be left smarting.

Meridian 400 Subnotebook

WINDOWS 1995 WIN 100 May 1995

"ZEOS is out to prove that good things do come in small packages with its Meridian 400C subnotebook," reported *Windows Magazine.*

At 3.9 pounds, the Meridian 400 is molded with a special carbon-fiber material that cuts weight and improves durability. And with a DX4-100MHz processor *standard*, it may well be the highest performance subnotebook available; "faster than a speeding desktop" is how *Computer Shopper* described it.

In addition to great performance, you also get hard drives to 350MB, RAM that's user upgradable to 20MB, two Type II PCMCIA slots, an external ultra-light 3.5" 1.44MB floppy drive (included in Packages 2 and 3) and your choice of active matrix or dual scan color screens. Amazing!

Meridian 800 Notebook

WINDOWS 1995 WIN 100 May 1995

"The 800C notebook offers sleek styling, solid construction and hot performance....one of the fastest notebooks we've ever tested," said *Windows Magazine.*

At 6.3 pounds, the Meridian 800 full-size notebook is light enough to travel anywhere yet, with its whopping 10.3" dual scan or 9.5" active matrix color display, is large enough to use for presentations and everyday computing.

To complete the package, you also get a DX4-100MHz CPU, up to 20MB of user-upgradable RAM, a removable hard drive to 528MB, a built-in 3.5" 1.44MB floppy drive and PCMCIA slots supporting two Type II or one Type III devices. Full desktop features that fit in your briefcase!

Meridian 850 Notebook

"On our Graphics Winmark 95 tests...ZEOS's Meridian 850C grabbed the top position. The ZEOS 850C again finished first on our Disk Winmark 95 tests," reported *PC Magazine.* Grade A+ for performance!

Imagine, today's most advance computing capabilities wrapped up in a 6.8 pound package. With features including your choice of Pentium® processors, a 256K synchronous SRAM cache, user-upgradable memory to 32MB, removable hard drives to 1.3GB, PCMCIA support for two Type

II or one Type III devices and a built-in 3.5" 1.44MB floppy drive, this is the notebook computer that rivals today's most advanced desktops!

With its blazing speed, your choice of a 10.3" SVGA (800 x 600) dual scan color display or 9.5" VGA active matrix color display *and* 16-bit Sound Blaster® compatible sound through audio jacks, your Meridian 850 is also a traveling multimedia whiz. Pure genius!

Buy With Confidence

No matter which Meridian notebook you purchase, you get the best service and support in the business! ZEOS has won seven *PC Magazine* Readers' Choice for Service & Reliability awards. And, ZEOS was the first to provide 24-hour toll-free technical support.

The ZEOS Meridian notebooks are a study in excellence. Their performance, quality, reliability and durability make them the class of the industry. And it's easy for you to get top honors, too. Just call your ZEOS Systems Consultant to order now at 800-554-5226. It's the smartest move you can make!

Package 1			Package 2			Package 3		
	400C	800C		400C	800C		400C	800C
DX4-100	$2195	$2495	DX4-100	$2495	$2695	DX4-100	CN! $2795	CN! $2995
➤ 4MB RAM ➤ 260MB IDE hard drive ➤ 800: Internal 3.5" 1.44MB floppy drive ➤ **MS Windows® 95** or MS-DOS 6.2 & Windows for Workgroups 3.11 ➤ **MS Works 95** or MS Works			➤ 8MB RAM ➤ 350MB IDE hard drive ➤ 3.5" 1.44MB floppy drive. 400: External, 800: Internal ➤ Custom nylon carrying case ➤ **MS Windows 95** or MS-DOS 6.2 & Windows for Workgroups 3.11 ➤ **MS Works 95** or MS Works			➤ 8MB RAM ➤ IDE hard drive. 400: 350MB, 800: 528MB ➤ 3.5" 1.44MB floppy drive. 400: External, 800: Internal ➤ **14.4 PCMCIA fax/modem** ➤ Custom carrying case. 400: Leather, 800: Nylon ➤ Extra battery ➤ **MS Windows 95** or MS-DOS 6.2 & Windows for Workgroups 3.11 ➤ **MS Works 95** or MS Works		
Pentium® Processor		**850C**	**Pentium® Processor**		**850C**	**Pentium® Processor**		**850C**
75MHz		**$3295**	**75MHz**	CN!	**$3795**	**75MHz**	CN!	**$4195**
90MHz		**$3495**	**90MHz**		**$3995**	**90MHz**		**$4395**
➤ 8MB RAM, 256K synchronous SRAM cache ➤ 528MB DE hard drive ➤ Internal 3.5" 1.44MB floppy drive ➤ Integrated 16-bit stereo sound ➤ **MS Windows 95** or MS-DOS 6.2 & Windows for Workgroups 3.11 ➤ **MS Works 95** or MS Works			➤ 16MB RAM, 256K synchronous SRAM cache ➤ **810MB** IDE hard drive ➤ Internal 3.5" 1.44MB floppy drive ➤ Integrated 16-bit stereo sound ➤ Custom nylon carrying case ➤ Extra battery ➤ **MS Windows 95** or MS-DOS 6.2 & Windows for Workgroups 3.11 ➤ **MS Office Pro 95** or MS Office Pro			➤ 16MB RAM, 256K synchronous SRAM cache ➤ **1.3GB** IDE hard drive ➤ Internal 3.5" 1.44MB floppy drive ➤ Integrated 16-bit stereo sound ➤ External amplified speakers ➤ **14.4 PCMCIA fax/modem** ➤ Custom nylon carrying case ➤ Extra battery ➤ **MS Windows 95** or MS-DOS 6.2 & Windows for Workgroups 3.11 ➤ **MS Office Pro 95** or MS Office Pro		

Prices shown include dual scan color display.
Upgrade to *ACTIVE* color display! Meridian 400 add only $700. Meridian 800 or 850 add only $800.

Included With Every ZEOS Meridian:

intel inside
pentium PROCESSOR

- ➤ 400 & 800: Intel® DX4-100 processor. 850: Intel® Pentium processor, 75MHz or 90MHz.
- ➤ 400 & 800: RAM expandable to 20MB. 850: RAM expandable to 32MB.
- ➤ IDE upgradable HDD. 400: to 350MB, 800: to 528MB, 850: to 1.3GB.
- ➤ PCMCIA slots. 400: 2 Type II, 800 & 850: 2 Type II or 1 Type III.
- ➤ Local bus video with 1MB video RAM.
- ➤ Display: Color VGA backlit LCD, up to 256 colors. 400: 640 x 480 7.9" DSTN or active matrix. 800: 640 x 480 10.3" DSTN or 9.5" active matrix. 850: **800 x 600** 10.3" DSTN SVGA or 9.5" 640 x 480 active matrix.
- ➤ Supports an external SVGA color monitor at resolutions up to 1024 x 768.
- ➤ 84-key keyboard with embedded numeric keypad, 12 dedicated function keys and inverted "T" arrow keys. Integrated TruePoint pointing device.
- ➤ Ports: Serial, parallel (850: enhanced EPP & ECP), external SVGA video, external keyboard or PS/2 mouse (800 & 850 both). 400 also with external floppy drive. 850 also with mic-in and stereo speaker-out.
- ➤ Replaceable, rechargeable NiMH battery.
- ➤ Full power management features.
- ➤ AC110-240V to DC adapter.
- ➤ 400C: 7.8" x 10.2" x 1.7"; 3.9 lbs. 800C: 8.9" x 11.7" x 1.9"; 6.3 lbs. 850C: 8.9" x 11.7" x 2.1"; 6.8 lbs.
- ➤ EPA Energy Star compliant.
- ➤ FCC Certified Class B; UL Listed.
- ➤ ZEOS Customer Satisfaction Package.

CN! –We can ship today! Call for details.
Fax Orders: 800-362-1205 or 612-362-1205. Phone Orders: Outside U.S. and Canada: 612-362-1212, Government: 800-245-2449. ZEOS Information Systems, Inc. GSA #GS00K94AGS5176. Purchase Orders, MasterCard, VISA, Am Ex, Discover, COD, Z-Card, & leasing programs.

800-554-5226 **24 Hours a Day 365 Days a Year**

ZEOS®

Purchase orders are subject to approval. Business leasing programs available. All prices, specifications and availability are subject to change without notice; call to confirm these and warranty details. Prices do not include shipping. The Energy Star emblem does not represent EPA endorsement of any product or service. All products and company names are trademarks or registered trademarks of their respective holders. Intel Inside Logos are trademarks of Intel Corporation. Windows is a registered trademark of Microsoft Corporation in the U.S. and other countries. ZEOS is a registered trademark; Z-Card is a servicemark; Meridian is a trademark of Micron Electronics, Inc. (c) 1995 MEI. ZEOS, 1301 Industrial Blvd., Minneapolis, MN 55413 USA. Micron Electronics, Inc. is a publicly traded company (NASDAQ symbol: MUEI). MER-BYT-9510

Printers to Go

We reviewed three portable printers that you can hook up to an ultraportable for a short print job if you're stuck in a hotel or an airport. These packable printers—the Mannesmann Tally (Kent, WA, (206) 251-5524) MobileJet ($350), the Pentax Technologies (Broomfield, CO, (303) 460-1600) PocketJet ($529), and the Citizen America (Santa Monica, CA, (310) 453-0614) PN60 ($399)—aren't built for speed or large-volume tasks, but they can get you out of a pinch if you need a hard copy of an invoice or a one-page document for an upcoming meeting.

Mannesmann Tally's MobileJet (4.6 pounds) is an ink-jet printer, and the smaller PocketJet (2.2 pounds) and PN60 (2.6 pounds) use variations of thermal-transfer technology to place ink on paper. The PocketJet is the most interesting because its direct thermal technology doesn't require ink cartridges, ribbons, or toner. The printer heats dye on special thermal paper supplied by Pentax. There is no toner to spill or inky ribbons to change, but the 8-cents-per-page cost of the paper can add up. The PN60 is the only one with color capabilities; its optional color print cartridge ($14.99 for a two-pack) replaces the printer's standard black-ink cartridge.

All three printers operate on both AC and battery power, and you can plug the MobileJet and the PN60 into a car's cigarette lighter with an optional adapter. The MobileJet is the most versatile printer because it doesn't require special paper and prints on envelopes, transparency film, and adhesive-backed labels. It is also the only one with a multiple-page feeder, so you don't have to feed the pages manually. The PocketJet pays a price for its unique printer technology: It doesn't print envelopes or adhesive-backed labels.

The PocketJet is the fastest printer on all but one of our printer performance tests. It prints at speeds of three text pages per minute with a maximum resolution of 300 dots per inch. The slim, rectangular PocketJet produces letter- and legal-size output and hooks up to your computer via a serial or parallel port. It has full Printer Control Language 4 (PCL4) LaserJet IIP compatibility and includes seven Hewlett-Packard internal fonts. Although the PocketJet is a single-sheet-feed printer, testers liked the way it goes back on-line when it's time to feed through the next sheet of paper.

The PocketJet's rechargeable nicad battery supports 30 to 35 pages per charge and installs easily inside the printer's 11-inch-long chassis. The printer has three status indicators (power, data, and battery), and a density dial on the left side lets you set how dark or light you want the print job to be. The PocketJet produces quality text output and line drawings, but its output on our black-and-white photograph test was washy and unpresentable. However, its combination of speed and quality on text output makes it a good choice for those who need to print forms or invoices in a hurry.

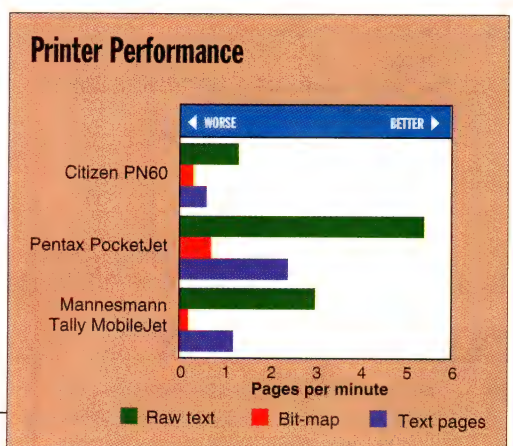
Hook up to an ultraportable with the Mannesmann Tally MobileJet (upper left), the Citizen PN60 (middle), and the Pentax PocketJet.

The Mannesmann Tally MobileJet is the heftiest portable in the test-bed, but it offers more features than the other printers. The bubble ink-jet printer supports resolutions of up to 300 dpi, and its cut-sheet feeder can hold up to 15 pages. You can purchase optional nicad and nickel-metal-hydride (NiMH) battery packs, or you can load in 10 AA batteries to power the printer when a power conduit is not nearby. Ink cartridges are easy to install.

The MobileJet, which looks more like a desktop printer than the others do, is faster than the PN60 in our text performance tests, but it is the slowest printer in our font and graphics tests. Despite its slow performance, it prints a much crisper photographic image (although still kind of blotchy) than do the other two printers. It also prints better-quality output in our more graphically complex print-quality tests. The easy-to-use printer has a print speed of 2 pages per minute and a bidirectional parallel interface, and it is HP DeskJet Plus (PCL3+)–compatible.

The PN60 has a rectangular chassis similar to that of the PocketJet, and the thermal-transfer PN60 offers the highest-resolution setting at 360 dpi. It is the only printer available with an optional RS-422 serial interface for a Mac (it also has a standard parallel interface and an optional RS-232 serial interface). The printer has five built-in fonts and supports industry-standard IBM and Epson emulations.

The PN60 was the slowest printer we tested, taking about four times as long as the PocketJet to print the text and raw-text tests, but it was slightly faster than the MobileJet on the font and graphics tests. The PN60 received only a fair printer-quality rating, because it had trouble printing reverse type (black on white), and its output in the photograph test was an imperceptible blur of pixels. Testers also had some bones to pick with the PN60. They encountered frequent paper jams and found that you must manually guide the paper into the single-sheet feeder perfectly straight for it to catch. They also discovered that its tiny buttons are hard to push. Despite these criticisms, the PN60 is the only choice if you need to highlight documents with a splash of color.



PRINTERS AT A GLANCE

	PRICE	WEIGHT (LBS.)	MAX. RESOLUTION (DPI)
Mannesmann Tally MobileJet	$350	4.6	300
Pentax PocketJet	$529	2.2	300
Citizen PN60	$399	2.6	360

Searching For The Best Multimedia Pentium Notebook?

STRIKE IT RICH WITH SOUNDX GOLD

JANUARY 1994 BYTE JANUARY 1994 GENERAL BUSINESS COLOR MONITOR

The **Sceptre Soundx Multimedia Pentium Notebook,** chosen BYTE Magazine's BEST OVERALL in head-to-head notebook comparisons, is now available in Sceptre's new **Gold Series.** This includes our Premium Service Program, Three Year Warranty and a handsome attache.

Add your voice to the growing list of satisfied Sceptre users. The Gold Series is offered through distribution. Call **1-800-788-2878.**

- Intel 90-MHz Pentium processor
- 10.2" DSTN/TFT with 16M colors in 640 x 480 resolution
- PCI bus to increase HDD and VGA speed
- Positive-touch keyboard with palm-rest design
- Built-in stereo speakers and microphone
- 256K cache memory, L2
- 6.3 pounds; 10.9" x 8.6" x 1.7"
- Infrared serial port
- Intelligent heat sensor; no fan needed

CERTIFIED ISO 9002 MANUFACTURER

3 YEAR WARRANTY

INGRAM MICRO
800-456-8000

"Brutus" is a monitor lizard

SCEPTRE®

EXCELLENCE FOR ALL THE WORLD TO SEE

SCEPTRE donates a portion of all profits to the Zoological Society of San Diego in support of C.R.E.S., the Center for Reproduction of Endangered Species.

© 1995 SCEPTRE Technologies, Inc. All Rights Reserved. All product and brand names are trademarks or registered trademarks of their respective companies.

Circle 125 on Inquiry Card (RESELLERS: 126).

How We Tested

To pick the best ultraportables, we first ran a suite of tests using applications-based tests and NSTL's InterMark performance benchmarks to determine the fastest systems. We also measured their endurance with our Thumper II battery run-down tests, examined their screen quality, and decided which ones were easiest to use and had the most important features. The performance scores are weighted most heavily, followed by the screen-quality, battery-life, features, and usability scores.

PERFORMANCE

We assessed the performance of each ultraportable with a suite of applications-based and low-level InterMark tests. Prior to testing, we installed MS-DOS 6.2 and Microsoft Windows for Workgroups 3.11 onto formatted hard disks.

NSTL's Windows-based, low-level InterMark tests exercise the Windows Graphical Device Interface (GDI), as well as low-level graphics, CPU, FPU, memory, graphics, and the hard drive systems. The GDI component determines how well a system executes basic graphics calls within Windows. We ran all the Windows-based tests in 640- by 480-pixel resolution at 256 colors (except the Compaq Contura Aero 4/33C Model 250, which supports only 16 colors) using vendor-supplied graphics drivers. These applications benchmarks employ widely used programs, such as WordPerfect, FoxPro, and Excel, and thus gauge real-world performance.

FEATURES

We asked each vendor to complete a questionnaire to give us a detailed description of each system's features and support options. We then weighted each feature and calculated an overall features score (see the Roll Call on page 164).

We focused on three aspects of screen quality: crispness, intensity/color range, and viewing range. The screen-quality tests measure horizontal and vertical line placement, the color and gray-scale depths, and the frequency of LCD streaking. We used Sonera Technology's DisplayMate Professional 1.0 to analyze a wide range of display capabilities. To determine color quality, we displayed a color bar on each screen and assigned a score ranging from 1 (worst) to 5 (best). After plotting the viewing range using NSTL's Heads-Up Range Device (HURD), we computed the group's viewing-angle scores.

We measured battery performance with BYTE's Thumper II system. Thumper emulates a typical word processing session; robotic arms and optical sensors detect and control each system's power management scheme. Prior to testing, we completely drained and recharged each system's battery according to the manufacturer's instructions. We then configured each notebook's power management features to spin down the hard disk after 2 minutes of inactivity and shut off the backlighting after 1 minute. We let each system enter standby mode during the test cycle. At intervals, Thumper's robotic arms would wake up each system so that it would run until the battery died.

You must interpret the results of any battery-life test, including our own, with some caution. People use their ultraportables differently, which uniquely affects a system's battery life.

USABILITY

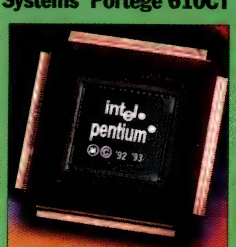
We also assessed the quality of each keyboard, concentrating specifically on key placement. We worked extensively with the ultraportables to see how comfortable they became after extended use, and we rated the response and feel of the keys. We also evaluated pointing devices for both right- and left-handed people and considered the usefulness of the LCD status indicators.

HOT CPU CHIPS KEEP THEIR COOL

There has always been a great compromise for users of portable systems: A faster (and hotter) CPU always meant shorter battery life. To end this trade-off, Intel has introduced 75- and 90-MHz Pentium processors specifically designed so that mobile systems perform better without compromising battery life.

The key to this paradox is Intel's Voltage Reduction Technology (VRT). It lets the Pentium processor operate at 3.3 V using off-the-shelf components, while its inner core operates at a cooler 2.9 V. This means that VRT-based Pentiums will consume as much as 30 percent less power than their desktop counterparts. The chips have a typical power dissipation of 2.5 to 3.5 W and idle power consumption of less than 1 W, according to Intel.

One of the first systems to debut with the Mobile 90 Pentium is Toshiba America Information Systems' Portégé 610CT (see the text box "The Incredible Shrinking Pentium" on page 148). By the time you read this, portable systems featuring the two new 2.9-V chips will be shipping from such leading vendors as AST Research, Compaq, Dell, Hewlett-Packard, and NEC.



The Intel Pentium: More power means less.

While Intel boasts that it will convert the entire notebook market to Pentiums by the end of this year, Cyrix has plans of its own. Cyrix showcased its mobile-slanted 5x86 CPU family last summer. According to Cyrix, it rivals 75-MHz Pentium performance. Power management features, which include System Management Mode (SMM), conserve power within the processor, as well as power flowing to peripherals.

One advantage of Cyrix's chip design that makes it attractive to vendors is that you can easily insert it into current 486 footprints. The chip will be in production in the fall, and many Taiwanese vendors (e.g., ASE, Chicony, Dataexpert, and Veridata) have shown preproduction 5x86-based notebooks. Epson plans to use the chip in upcoming portable and desktop systems.

Contributors

Rex Baldazo, Technical Editor/BYTE

Maggi Bender, Tester/NSTL

Stanford Diehl, Director of Product Reviews/BYTE

Siva Kumar, Senior Tester/NSTL

Anthony J. Lennon, Project Manager/NSTL

John McDonough, Technical Editor/NSTL

Tom Thompson, Senior Technical Editor at Large/BYTE

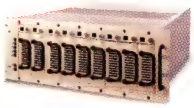
The Lab Report is an ongoing collaborative project between BYTE magazine and National Software Testing Laboratories (NSTL). BYTE magazine and NSTL are both operating units of McGraw-Hill, Inc. Contact the NSTL staff on the Internet at editors@nstl.com or by phone at (610) 941-9600. Contact BYTE on the Internet or BIX at editors@bix.com or at (603) 924-2624.

Our storage devices can endure long hours, natural disasters, and other forms of abuse.

[Not unlike a day at the office.]

The DE100™ is a removable disk/tape subsystem that allows you to easily remove, transfer, and store data. It's compatible with an extensive variety of standard SCSI or IDE/EIDE drives.

With room for three 1" SCSI disk or tape drives, the DS300 model is the most compact removable storage subsystem available on the market today.



The DS500™ is an external rack mount that houses nine half-height bays, allows users to integrate any SCSI peripheral combination, and includes up to two 300-watt power supplies.

An ideal storage chassis for workstations, network servers, and PCs, the DS100 provides flexibility for users to mix and match up to four SCSI peripherals.

When it comes to protecting valuable data, only Kingston's rugged storage devices have shown they can brave the elements. Though they were designed to perform in the most demanding commercial environments, they're also tough enough to survive in army bunkers, submarines, and even in spacecraft. Our Data Silo® enclosures and Data Express™ removables are constructed of rugged steel with a carefully designed and tested ventilation system for cooling today's high-performance drives. Used in computer rooms, workstations, and network servers, they support more SCSI connections and have more options than any other storage subsystem on the market. If that doesn't impress you, our unbeatable five-year warranty will. So call Kingston or your nearest dealer for more information. Because in the world of storage systems, only the strong survive.

Kingston TECHNOLOGY CORPORATION

Call (800) 435-0670 or find us at http://www.kingston.com

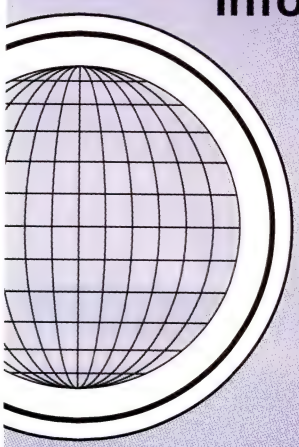
Kingston Technology Corporation, 17600 Newhope Street, Fountain Valley, CA 92708 USA, (714) 438-1850, Fax (714) 438-1847.

© 1995 Kingston Technology Corporation. Kingston Technology is a registered trademark of Kingston Technology Corporation. All rights reserved.

Circle 78 on Inquiry Card (RESELLERS: 79).

LIFE JUST GOT EASIER!

Datapro has the First One-Stop, Electronic Source for Unclassified Information Security Documents and Directives:



DATAPRO

GTAC 3 SERIES

Government Technologies & Computers, Communications, and Control

Security and Regulations Segment

GSA #: GS00K94AGS5102-PS01

Until now, locating unclassified government security information quickly – and keeping it in one convenient place – has been next to impossible.

Datapro Information Services Group's new monthly updated CD-ROM, "GTAC^3," is the solution for quick, easy access to unclassified security data from sources such as:

- ***NCSC's "Rainbow Series"***
- ***Carnegie-Mellon University's CERT Advisories***
- ***NCSC Conference Proceedings***
- ***Computer Security Laboratory Bulletins***
- ***DoD Regulations***
- ***DOE Directives***
- ***NIST's Federal Information Processing Standards (FIPS)***
- ***Public Laws***

GTAC^3 includes over 200 unclassified documents, News Briefs, Calendar of Events – plus full coverage of the global information security industry.

For more information, call or fax us today.

Datapro Information Services Group

A Division of The McGraw-Hill Companies

600 Delran Parkway, Delran, NJ 08075
Tel: 800-328-2776, 609-764-0100 Fax: 609-764-2812

McGraw-Hill House, Shoppenhangers Road
Maidenhead, Bershire, England SL6 2QL
Tel: +44 1628 773277 Fax: +44 1628 773628

20 Cecil Street, 21-07 The Exchange, Singapore 0104
Tel: +65 5384432 Fax: +65 5384436

- Full 486 support including DX4-100
- LCD options up to 10.4" TFT color
- Support for extra battery or CD-ROM drive in FDD bay
- Optional 16-bit stereo audio card and internal speakers
- Two PCMCIA Type II slots or one Type III slot

Take The Multimedia And Run!

Want multimedia? Take it.
With MITAC's 4024, you can have an internal CD-ROM drive and 16-bit stereo audio. Get access to thousands of exciting multimedia applications in a system with support for the full range of 486 CPUs up to and including the speedy DX4-100.

Want portability? Take that too.
PCMCIA support. Built-in front-centered trackball. Screen options ranging up to a 10.4" TFT color LCD. Floppy disk drive swappable with a 2nd battery pack or CD-ROM drive. With MITAC's 4024, you can get your multimedia in an uncompromising portable package.

So go ahead, take the multimedia. And then run with it!

MiTAC

■ **MITAC INTERNATIONAL CORP.** Tel:886-2-501-8231 Fax:886-2-501-4265 ■ **MITAC EUROPE LTD.**--Tel:44-1952-207200 Fax:44-1952-201216 ■ **MITAC JAPAN CORP.**--Tel:81-3-54202822 Fax:81-3-54204586 ■ **MITAC AUSTRALASIA PTY. LTD.**--Tel:61-3-5851055 Fax:61-3-5851596 ■ **MITAC DE MEXICO, SA DE CV**--Tel:52-5-2603399 Fax:52-5-2600616 ■ **MITAC PACIFIC (H.K.) LTD.**--Tel: 852-5286782 Fax: 852-8613754 ■ **MITAC BEIJING**--Tel:86-1-8492661 Fax:86-1-8492663 ■ **BAHRAIN**--Mantech Computer Tel:973-731717 ■ **BRUNEI**--OA System Computer Tel:673-2-244640 ■ **EGYPT**--EGOS Tel:202-2588392 ■ **INDONESIA**--P.T. Mastersystem Infotama Tel:62-21-3518108 Fax:62-21-3867188 ■ **ISRAEL**--Milton Tel:972-3-9255255 Fax:972-3-9255222 ■ **JORDAN**--Comcent Tel:962-6-644246 ■ **KUWAIT**--ZAID AL-KAZEMI SONS Tel:965-2451680 ■ **MALAYSIA**-- Micro Education Tel: 603-7364803 Fax: 603-7365861 ■ **OMAN**--W.J. Towell Tel:968-702907 ■ **PHILIPPINES**--Integrated Computer Systems Tel:632-722-4111 Fax:632-721-2113 ■ **SAUDI ARABIA**--NAHIL Tel:1-4645373 Fax:1-4645365 ■ **SOUTH AFRICA**--AZ Computer Tel:27-11-8050452 Fax:27-11-8050457 ■ **SYRIA**--NSCC Tel:963-11-2228736 ■ **THAILAND**--Innovative Technology Tel:662-559-2419 Fax:662-559-2418 ■ **TUNISIA**--Standard Sharing Software Tel:216-1-796000 ■ **TURKEY**--Albim Tel:0-216-3493351 Fax:0-216-3477069 ■ **UAE**--AL Yousuf Computers Tel:971-4-826667

Circle 528 on Inquiry Card.

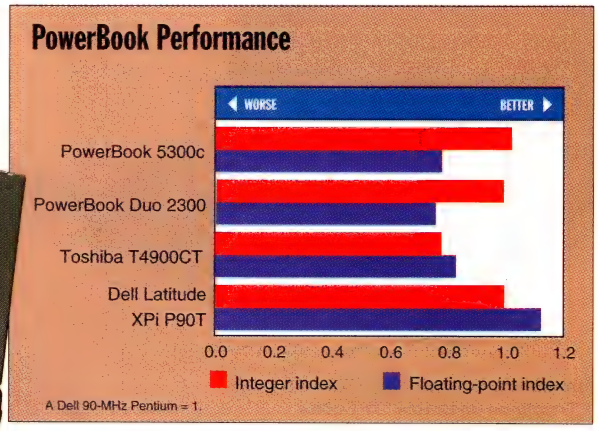
Apple's Dynamic Duo

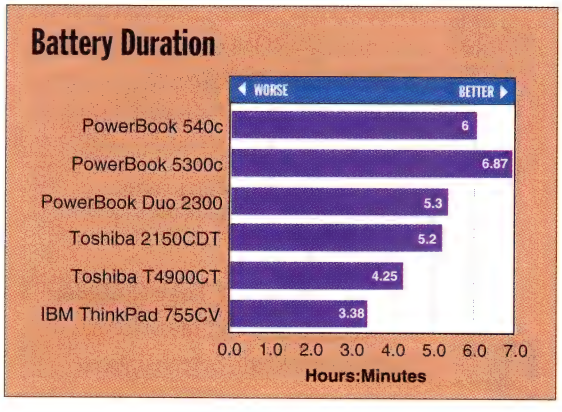
In August, Apple migrated its ultraportable computer line (called the PowerBook Duo) to the PowerPC processor. Recast as the PowerBook Duo 2300, it provides RISC power while holding the line on power consumption. It measures only 8.5 by 10.9 by 1.5 inches and tips the scales at only 4.8 pounds, making it a welcome addition to anyone's briefcase.

The Duo 2300 uses a PowerPC 603e, which has two 16-KB on-chip caches (one for data and one for code) and several power-saving modes. The processor can idle certain subsystems (e.g., the FPU or perhaps the data cache) when they're not in use. A single Type III nickel-metal-hydride (NiMH) battery provides an estimated 2 to 4 hours of battery life. Base system RAM is 8 MB, which is expandable to a maximum of 64 MB. Internal hard drives start at 750 MB and can be as large as 1.1 GB.

The Duo has a 9½-inch backlit active-matrix LCD screen that's a trifle small but readable. The engineering compromises made to achieve the Duo's slim form factor are a minimal set of I/O ports. It has a slot and an RJ-11 connector for an internal modem and a mini-DIN-8 serial connector that can function as a LocalTalk network port, printer port, or modem port, if required. Behind a hinged door lies a connector for plugging the computer into Apple's docking station, the Duo Dock. An optional small floppy docking unit can plug into this connector to provide ports for Apple Desktop Bus (ADB) and a floppy drive. This makes the computer more capable for stand-alone work but requires that you remember to pack the docking unit and the floppy drive.

Apple's PowerBook Duo 2300c.





The 603e's low power consumption, combined with Apple's power-conservation software, delivers long battery life. The BYTE battery-life tests showed that the Duo 2300 operated for 5½ hours. In terms of performance, the Duo 2300 weighs in with an integer BYTEmark of 0.986029 and a floating-point BYTEmark of 0.752184. Prices start at $3500 for a Duo 2300c with 8 MB of RAM, a 750-MB hard drive, and a 9½-inch active-matrix LCD screen.

—Tom Thompson

Product Information

Apple PowerBook Duo 2300 . . . . . .$3500 and up
Apple Computer, Inc.
Cupertino, CA
(800) 776-2333
(408) 996-1010
Circle 1228 on Inquiry Card.

COLOR FOR THE ROAD

If you happen to be on the road with your trusty color PowerBook and you need to knock out a full-color document for a client, whom are you going to call? Now you can have your color files and print them, too, with Apple's Color StyleWriter 2200 (priced at $419). This portable color ink-jet printer prints at resolutions of 360 dots per inch and can accept plain paper, medium-weight labels, #6 and #10 envelopes, and transparency film. It measures in at just 2.2 by 11.8 by 6.2 inches and weighs in at just over 3 pounds (4.2 pounds with the battery attachment).

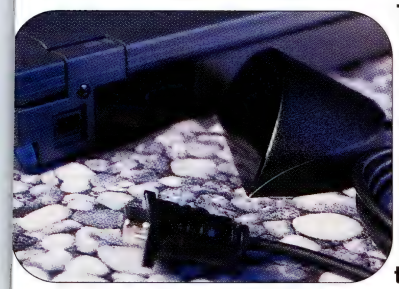
The printer takes only a few minutes to set up and consists mainly of clipping either a black- or color-ink cartridge into the print-head assembly. A storage case holds the ink cartridge when you travel with the printer. The printer connects to a PowerBook via a serial cable. Several floppy disks contain the printer-driver software and 19 additional TrueType fonts.

Printing speeds are determined by two factors. First, the more gutsy the PowerBook's processor is, the faster the driver generates the page image. For best appearances, you'll want to have your application generate page images at 144 dpi or better, which means more data must be shipped to the printer. This, in turn, slows the printing process. But the wait is worth it: Color output is gorgeous and rivals the output quality of the Hewlett-Packard 1200C ink-jet printer. **—TT**

For quality color in a portable package: the Apple Color StyleWriter 2200.

HONORABLE MENTIONS

Tired of fumbling around behind your desktop system for a serial port every time you have to transfer files to and from your desktop system and ultraportable?



The Gateway 2000 Liberty DX4-100 Deluxe, the IBM ThinkPad 701C, and the Hewlett-Packard OmniBook 600CT have infrared ports and accompanying software for wireless data transfer. You point the Irda-compliant ports on these advanced ultraportables to an infrared module connected to the desktop to exchange files, or to an infrared-capable printer to print documents.

The ThinkPad 701C comes with an expansion unit (it attaches to the back of the system) called the MultiPort II, which has eight ports for a serial device, a parallel device, audio input and output devices, a keyboard, a mouse/numeric keypad, a power port, and an external display. The module weighs less than one-half pound, and you can leave it home if you don't anticipate attaching external devices during your jaunt.

PRIMAX'S COLORMOBILE OFFICE

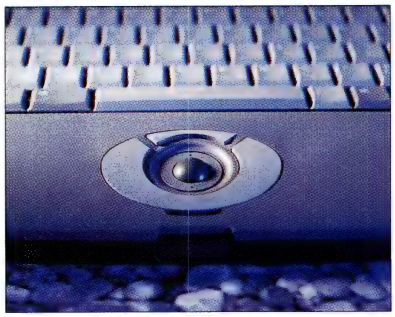
So you've picked your ultraportable and portable printer. What's left? How about a color scanner for the road that can handle almost any scan job. Primax Electronics' (Campbell, CA, (800) 338-3693 or (408) 364-2800) ColorMobile Office ($289) features a modular design so that you can snap on attachments for hand-held, sheet-fed, and self-motorized scanning of images and documents.

The ColorMobile Office weighs only 2 pounds and supports any image mode from black-and-white up to 24-bit true color at resolutions ranging from 100 to 400 dots per inch. The ColorMobile Office working alone as a hand-held scanner can scan pages from a book or manual. If you have shaky hands, the Motor Module attachment rolls the scanner along a flat trackpad for up to A4-size documents. The Office Feeder sheet-fed module sucks in 4-inch-wide business cards or photographs.

Primax's ColorMobile Office lets you scan documents while in transit.

The scanner is bundled with the TWAIN-compatible ImagePals Go file management and image-editing software. It also includes ReadIris Intelligent Text Recognition OCR software to edit scanned-in text files. ColorMobile Office works on AC power and hooks up to a system via the parallel port.

Digital Equipment put a lot of thought into the trackball on its HiNote Ultra CT475. The left-click mouse button wraps almost entirely around the trackball, while the seldom-used right-click button is just a sliver above the trackball.



Dubious Achievements

On the two Austin ultraportables, the Sceptre TS37 Subnotebook, and **Gateway's Liberty**, you have to pull the external floppy drive off the parallel port if you want to connect a parallel-attached network adapter, printer, or external CD-ROM drive. The Compaq Contura Aero 4/33C Model 250 uses its PC Card (formerly PCMCIA) slot for its external floppy drive, which occupies a valuable expansion slot. The other ultraportables have ports dedicated for their external floppy drives.

Hewlett-Packard's OmniBook 600CT gets one of the best usability ratings, but its mouse that pops out the side of the system is really annoying. The mouse attaches to the ultraportable via a plastic leash that not only proved restrictive when moving the cursor but also felt like it would break off with a quick jerk.

Zinc-Air Batteries Last All Day

In portable computing, no technology seems to be changing more rapidly than that of batteries. Today, nicad batteries are being eclipsed by nickel-metal-hydride (NiMH) and lithium-ion cells. On the horizon, however, are zinc-air batteries that can power a laptop for between 10 and 15 hours.

AER Energy Resources ((404) 433-2127) has developed zinc-air batteries (priced at $399) for portable systems from Toshiba, Hewlett-Packard, and Zenith that can last an entire workday. Zinc-air cells, which store 150 watt-hours of energy, have two to three times more gravimetric energy than nicad and NiMH batteries, but the batteries are boxy and bulky at about 4 pounds. These batteries use oxygen from the air to support reactions that generate electricity, and they need more airflow than other batteries.

Besides the benefit of longer running time, zinc-air batteries lack the memory effect found in nicad batteries, so you can recharge them anytime rather than waiting until the battery is totally drained. The batteries, however, endure only 25 to 50 recharge cycles, but according to AER representatives, you get 200 to 400 hours of total run time from a zinc-air battery, which is about the same as with nicad and NiMH batteries that have 200 to 300 recharge cycles.

Introducing The Gateway 2000 Solo Portable Multimedia PC!

GATEWAY2000 SOLO™

Life is an adventure. Packed with twists and turns because you never take the beaten path. You need a computer that's up for the ride, but won't weigh you down. It's time to go solo.

The Gateway 2000 Solo™ PC is your ultimate Microsoft® Windows® 95 portable. Priced from $3499, this Pentium® processor-based multimedia portable melds our famous values with cutting-edge technology. The Gateway 2000 Solo PC is outfitted to be your primary computer, and starting at only 5.6-pounds,* ready to roll through even the most rugged computer terrain.

It's full-featured and will be your companion on every junket, from the rugged outback to the urban jungle. Choose your model with a 75MHz or 90MHz Pentium processor. All Gateway Solo models have a removable hard drive, minimum 8MB RAM, 256K L2 cache, modular bay for 3.5-inch floppy or CD-ROM drive, full-sized keyboard with Windows 95 keys, and either MS Office 95, Professional Edition or MS Works 95.

And because the most scenic panoramas don't include outlets, you'll get a high-capacity lithium battery for hours of computing power. It'll just be you and your Gateway Solo portable PC traversing the globe. Everything you need, right at your fingertips. And when you're called back to home base, its optional docking bar allows easy connection to a host of external gear including a monitor, keyboard and printer.

What's keeping you tied to the office? Multimedia is no longer relegated to desktop computers. With this portable's large active matrix color display, modular CD-ROM drive, integrated stereo speakers and microphone you get multimedia wherever your travels take you.

All portables from Gateway 2000® are built rock-solid with quality in mind. We know that occasionally a pothole appears on life's highway, so every Gateway portable comes with 24-hours, seven-day a-week technical support.

So the next time you hear the call of the wild, go solo! *Call Gateway 2000 today for more information!*

**Configuration includes: 540MB Hard Drive, SVGA Active Matrix Color Display and Option Bay Cover.*

90 DAYS NO PAYMENTS

GATEWAY2000

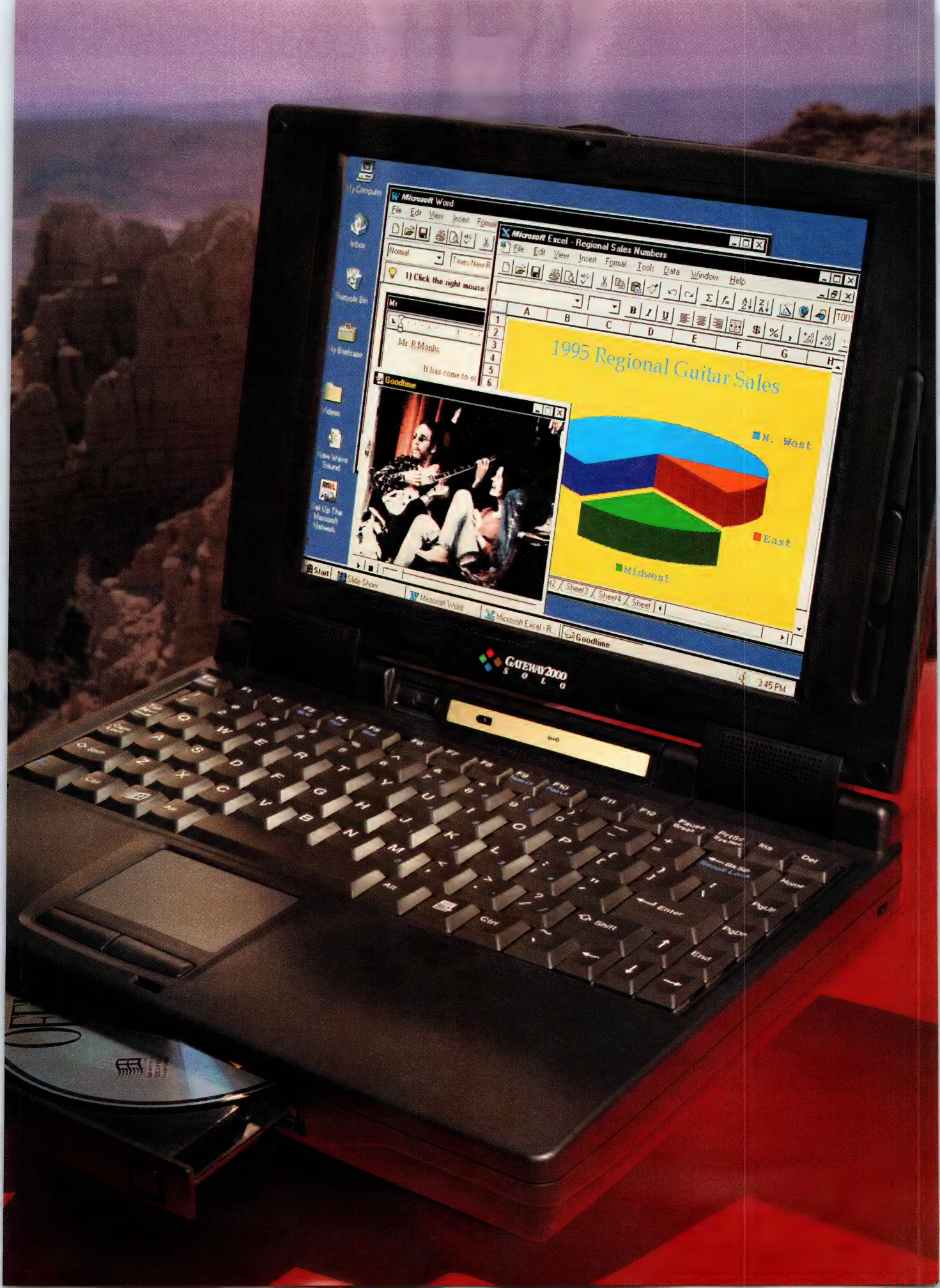
"You've got a friend in the business."®

800-846-4289

intel inside® pentium® PROCESSOR

610 Gateway Drive • P.O. Box 2000 • N. Sioux City, SD 57049-2000 • Phone 605-232-2000 • TDD 800-846-1778 • Fax 605-232-2023 • FaxBack 800-846-4526 • Component Add-On Sales 800-846-2080 • Sales Hours: 7am-10pm Weekdays, 9am-4pm Saturdays (CDT)

©1995 Gateway 2000, Inc. Gateway 2000, black-and-white spot design, "G" logo and "You've got a friend in the business" slogan are registered trademarks, and EZ Pad and Gateway 2000 Solo are trademarks of Gateway 2000, Inc. The Intel Inside Logo, Intel and Pentium are registered trademarks of Intel Corporation. All other brands and product names are trademarks or registered trademarks of their respective companies. All prices and configurations are subject to change without notice or obligation. Prices do not include shipping or applicable sales tax.


Microsoft Word
Microsoft Excel - Regional Sales Numbers
1995 Regional Guitar Sales
N. West
East
Midwest
Goodtime
GATEWAY2000
SOLO

ROLL CALL OF ULTRAPORTABLES TESTED

	AT&T GLOBAL INFORMATION SOLUTIONS GLOBALYST 130	AUSTIN DIRECT 486 STEPLITE NOTEBOOK	AUSTIN DIRECT 486 STEPLITE NOTEBOOK	COMPAQ COMPUTER CORP. CONTURA AERO 4/33C MODEL 250
Price as tested	$2223	$2065	$2407	$1199
Performance rating	5.6	4.6	6.1	3.4
Features/ease of use	7.9/7.7	7.1/7.8	7.2/7.8	6.2/6.6
Screen quality	7.3	7.0	6.2	2.7
Battery life (hr:min:sec) as tested	3:52:28	2:52:15	3:18:33	4:22:47
Traveling weight (lbs.)[2]	6.1	6.4	6.6	5.7
MICROPROCESSOR				
CPU/MHz	486DX4/75	486DX2/50	486DX4/75	486SX/33
Voltage	3.3	5.0	3.3	5.0
SYSTEM RAM				
RAM as tested/max. RAM (MB)	8/20	8/20	12/20	8/20
Memory speed (ns)	70	70	70	70
Memory architecture	Noninterleaved	Fast-paged	Fast-paged	Paged
SYSTEM BIOS				
BIOS vendor	SystemSoft	Phoenix	Phoenix	Compaq
Flash ROM upgradable	●	●	●	●
System ROM BIOS shadowing	●	●	●	●
Video ROM BIOS shadowing	●	●	●	●
VIDEO				
Screen manufacturer	Sharp	Sharp	Sharp	N/A
Graphics accelerator manufacturer/model	Chips & Technologies 65535	ACC 2066NT	ACC 2066NT	N/A
Diagonal screen size (inches)	10.4	9.5	9.5	7.8
Display technology	Passive-matrix	Passive-matrix	Passive-matrix	Passive-matrix
Max. display resolution (pixels)/total colors	640x480/256	640x480/256	640x480/256	640x480/16
Graphics memory as tested/bus width (bits)	512-KB DRAM/32	512-KB DRAM/32	512-KB DRAM/32	512-KB DRAM/16
External VGA display support	●	●	●	●
Max. ext. display resolution (pixels)/total colors	1024x768/16 million	1024x768/256	1024x768/256	640x480/16
Simultaneous int. and ext. display/key-activated toggle for display selection	●/●	●/●	●/●	❍/●
BATTERY				
Battery type	NiMH	NiMH	NiMH	NiMH
Supports multiple battery packs/hot swapping	❍/●	❍/❍	❍/❍	❍/❍
MASS STORAGE AND FLOPPY DRIVES				
Hard drive manufacturer and model	Toshiba MK1824FCV	Toshiba MK1824FCV	Toshiba MK1924FCV	Compaq 250
Hard drive interface type/average access time (ms)	IDE/13	IDE/13	IDE/13	IDE/17
Hard drive controller cache (KB)	128	128	128	None
Hard drive formatted capacity/largest available (MB)	340/540	335/810	517/810	250/250
Removable hard drive	●	●	●	❍
Standard 3½-inch floppy drive	Internal	External	External	External
I/O PORTS (BUILT IN)				
Number of nine-pin serial ports	1	1	1	1
Number of 25-pin serial ports	N/A	1	1	N/A
UART type	16550	16550	16550	16550
Centronics parallel port	Bidirectional	EPP	EPP	EPP
Pointing device	Trackball	Trackball	Trackball	Trackball
External keyboard port	●	●	●	❍
Type II/Type III	N/A/1	N/A/1	N/A/1	1/N/A
Other I/O ports	N/A	N/A	N/A	N/A
SOUND				
Integrated sound	❍	❍	❍	❍
Built-in microphone	N/A	N/A	N/A	N/A
Ext. microphone port	N/A	N/A	N/A	N/A
Ext. speaker port	N/A	N/A	N/A	N/A
Volume control	N/A	N/A	N/A	N/A
ADDITIONAL FEATURES				
Embedded/overlaid numeric keypad	●	●	●	●
Wattage	24.0	30.4	30.4	10.0
Switchable voltage	●	●	●	❍
SOFTWARE				
DOS disks included	●	●	●	❍
Microsoft Windows 3.1 disks included	●	❍	❍	❍
Microsoft Windows for Workgroups disks included	❍	●	●	❍
Other	AT&T Mail Access Plus, OAG FlightDisk, AT&T Vistium, Share, CompuServe, GEnie, Prodigy, WinComm Lite	Microsoft Office Standard 4.2	Microsoft Office Standard 4.2	TabWorks, WinLink Transfer Utilit and Lotus Organizer
MISCELLANEOUS				
14.4-Kbps fax modem	N/A	N/A	N/A	N/A
External battery charger (for secondary battery)	Included	Optional	Optional	Optional
Additional battery	Optional	Optional	Optional	Optional
Standard warranty length (years)/coverage	1/P, L, R	1/P, L	1/P, L	3/P, L, F, R
VENDOR INFORMATION				
Toll-free phone	(800) 447-1124	(800) 752-1577	(800) 752-1577	(800) 345-1518
Phone	(513) 445-5000	(512) 339-3500	(512) 339-3500	Call local Compaq dealer.
On-line address	pcc.info@daytonoh.attgis.com	http://www.ipctechinc.com	http://www.ipctechinc.com	http://www.compaq.com
Inquiry number	**1229**	**1230**	**1231**	**1232**

= BYTE Best. ●= yes; ❍ = no; N/A = not applicable.

[1] Not SL-enhanced.
[2] The traveling weight includes the system and its components, such as a floppy drive, adapters, and a battery pack.
[3] One optional extra Type III in expansion dock.

DIGITAL EQUIPMENT CORP. HINOTE ULTRA CT475	GATEWAY 2000 LIBERTY DX4-100 DELUXE	HEWLETT-PACKARD CO. OMNIBOOK 600CT	IBM PC CO. THINKPAD 701C [1]	SCEPTRE TECHNOLOGIES, INC. TS37 SUBNOTEBOOK	ZEOS INTERNATIONAL MERIDIAN 400A	ZEOS INTERNATIONAL MERIDIAN 400C
$4999	$4499	$3999	$4599	$1695	$3495	$2795
7.1	9.9	6.4	6.4	3.9	7.7	7.6
7.8/7.9	8.4/7.8	6.3/8.3	8.0/8.1	7.0/7.7	7.1/8.0	7.1/8.0
10.0	3.6	8.1	8.2	3.0	9.9	6.4
4:39:55	4:15:12	5:46:10	2:08:32	3:31:48	2:29:49	2:20:39
5.6	6.1	5.8	6.4	6.4	6.0	6.0
486DX4/75	486DX4/100	486DX4/75	486DX4/75	486SX/33	486DX4/100	486DX4/100
3.3	3.3	3.3	3.3	5.0	3.3	3.3
8/24	24/24	8/32	8/24	8/12	8/20	8/20
70	70	70	70	70	70	70
Interleaved	Paged	Paged	Paged	Interleaved	Fast-paged	Fast-paged
SystemSoft	SystemSoft	Phoenix	IBM PC Co.	SystemSoft	Phoenix	Phoenix
●	●	●	●	●	●	●
●	●	●	●	●	●	●
●	●	●	●	○	●	●
Toshiba	Sharp	Toshiba	Sharp	Sharp	Toshiba	Toshiba
Chips & Technologies 65545	Chips & Technologies 65545	Chips & Technologies 65545	Chips & Technologies 65545	Chips & Technologies 65540	Cirrus 6440	Cirrus 6440
9.5	10.4	9.5	10.4	9.5	7.9	7.9
Active-matrix	Dual-scan	Active-matrix	Active-matrix	Dual-scan	Active-matrix	Dual-scan
640x480/256	640x480/256	640x480/65,536	640x480/256	640x480/256	640x480/256	640x480/256
1-MB VRAM/32	1-MB DRAM/32	1-MB DRAM/32	1-MB DRAM/32	512-KB DRAM/16	1-MB DRAM/32	1-MB DRAM/32
●	●	●	●	●	●	●
1024x768/16 million	1024x768/256	1024x768/65,536	1024x768/16 million	1024x768/256	1024x768/256	1024x768/256
●/●	●/●	●/○	●/●	●/●	●/●	●/●
Lithium-ion	Lithium-ion	Lithium-ion	Nicad (optional NiMH)	NiMH	NiMH	NiMH
○/○	○/●	○/○	○/●	○/●	○/○	○/○
Toshiba MK1824FCV	IBM DBOA-2720	Integral Viper 260	IBM DBOA-2360	Hitachi DK221A34	Areal A340	Areal A340
IDE/12	IDE/13	PC Card ATA/16	IDE/13	IDE/12	IDE/12.3	IDE/12.3
256	N/A	32	64	64	32	32
528/528	720/720	260/260	540/720	250/820	350/350	350/350
○	●	●	○	●	○	○
External	External	External	External	External	External	External
1	1	1	1	1	1	1
1	1	N/A	N/A	N/A	N/A	N/A
16550	16550	16550	16550	8250	16550	16550
EPP	EPP	Bidirectional	EPP	Unidirectional	Bidirectional	Bidirectional
Trackball	EZ Point Integrated Pointer	Pop-out mouse	TrackPoint III	Trackball	TruePoint	TruePoint
●	●	○	●	●	●	●
N/A/1 [3]	None/1	N/A/1	N/A/1	1/None	2/None	2/None
N/A	N/A	Infrared	Irda, audio I/O, headphone, speaker, and microphone	N/A	N/A	N/A
●	○	●	●	○	○	○
○	N/A	●	●	N/A	○	○
●	N/A	●	●	N/A	○	○
●	N/A	●	●	N/A	○	○
●	N/A	●	●	N/A	●	●
●	●	●	●	●	●	●
30.0	35.0	40.0	30.0	25.7	37.0	37.0
●	●	●	●	●	●	●
○	●	○	●	●	●	●
○	○	○	○	●	○	○
○	●	○	●	○	●	●
OAG FlightDisk, Lotus Organizer, TranXit, CompuServe, InterNav for Delphi	OAG FlightDisk, Ascend, and Microsoft Office	LapLink Remote, AOL, CompuServe, and Day-Time Organizer	N/A	N/A	Microsoft Works	Microsoft Works
N/A	Included	N/A	Included	N/A	Included	Included
Optional	Optional	Optional	N/A	Optional	N/A	N/A
Optional	Included	Optional	Optional	Optional	Included	Included
3/P, L, R	1/P, L, R	3/P, L, F	3/P, L, F, R	1/P, L, R	1/P, L, F, R	1/P, L, F, R
(800) 642-4532	(800) 846-2000	(800) 443-1254	(800) 426-2968	(800) 788-2878	(800) 554-5226	(800) 554-5226
(508) 460-8894	(605) 232-2000	(503) 715-4100	(914) 766-1900	(818) 369-3698	(612) 623-9614	(612) 623-9614
on CompuServe, go DEC	on CompuServe, gateway2000	http://www.hpcvbbs.externalhp.com	http://www.ibm.com	100573.714@compuserve.com	on CompuServe, go zeos	on CompuServe, go zeos
1233	**1234**	**1235**	**1236**	**1237**	**1238**	**1239**

Warranty:
P = parts
L = labor
F = freight to repair center
R = return to customer

BYTE ON NETWORKING

BYTE has compiled every major article written on networking from the January 1993 issue through the October 1994 issue on a multiple disk set. With easy-to-use search and retrieve capabilities, this fully indexed text database allows you to access valuable technology and product information from networking product reviews, features, news analysis, and technical columns from the pages of BYTE. All articles are written by BYTE's staff, contributors, and other industry experts.

ONLY $14.95!
3-Disk Set

AVAILABLE ON DISK!

Here are just a few of the articles you'll find on disk:

- Network Connections
- Fine-Tune LANtastic
- Linking LANs
- Printers Talk Back
- NetWare Goes Global
- Modems for High-Speed Communications and Portability
- Digital Remote Access
- Network Management Systems
- Enterprise Computing
- Report on Networking
- LANs Make the Switch
- Wireless Mobile Communications

PLUS MORE!

Place Your Order Today!

For telephone orders using a credit card (MasterCard, VISA, or American Express)

CALL 1-800-924-6621

Complete order form and send to: BYTE on Networking, Attn. Circulation Dept., One Phoenix Mill Lane, Peterborough, NH 03458 or fax to 603-924-2603

❑ Check Enclosed
(Make checks payable to BYTE Magazine, US funds only)

❑ MasterCard ❑ VISA ❑ AMEX

Card # _____ Exp. Date _____

Signature _____

Name _____

Address _____

City _____ State _____

Country _____ Zip _____

DK4127

Canadian and U.S. orders, please add $2.95 for shipping and handling.
Outside North America, add $5.00 for air mail delivery. Please allow 6-8 weeks for delivery.
Disk format 3 1/2 inch. Currently available for Windows only.

BYTE FOLIO INFOBASE

Because the *Experts* decide.

Is There a GLINT in Your Future?

A close look at a coprocessor that accelerates 3-D graphics

TREVOR MARSHALL
AND JOHN DAVEY

Both the Pentium and the PowerPC deliver sufficient horsepower to display 3-D images on desktop computers. But as powerful as these processors are, to offer real-time support of 3-D imagery, they require an assist from dedicated hardware.

The GLINT chip from 3Dlabs is the most mature of all the chips, from several manufacturers, that will bring true 3-D graphics display capabilities to the desktop over the next few years. These chips won't produce images like you see in Hollywood films because they use a technique called Gouraud shading instead of the more photorealistic ray-tracing mechanism. But they do produce images that can move fast enough to fool the eye into the illusion of three dimensions.

In this article, we will explain how the GLINT 300SX chip connects to external hardware and how a GLINT board produces fast real-time 3-D displays. We will also look at a few features that 3Dlabs added to the chip to make 3-D displays really sizzle.

3-D Display Basics

A lot of hardware and software technology goes into producing a 3-D graphics display system. Chips such as the GLINT 300SX can produce 300,000 Gouraud-shaded triangles per second, but very few software packages are currently capable of driving them to this capacity. Even a 120-MHz Pentium processor with a fast PCI bus connected to the GLINT is capable of generating only about 200,000 triangles per second.

Several factors limit the speed of 3-D operations. A lot of information has to be passed over the bus. It takes 29 32-bit parameters to describe each of the two shaded triangles that make up a polygon. This translates into a sustained data rate of 10 MBps, which is impractical over an ISA bus and even difficult for the PCI bus (see "Fast Transit," October 1992 BYTE). The applications software itself also has to keep track of an extra dimension of parameters, which places a further load on the CPU. So a ton of thought has been put into ways in which the graphics processor can reduce the computing load on the host CPU.

The GLINT not only handles multiple display windows (so only part of a screen needs updating between frames), it also keeps track of Z-buffer data (used to plot only those objects in the "front" of the image). In addition, the chip manages the alpha blending (transparency); fogging (which enhances the illusion of depth); copying (which moves a cube of 3-D data, not just a 2-D image plane); and dithering (a technique for interpolating colors to make surfaces look smoother).

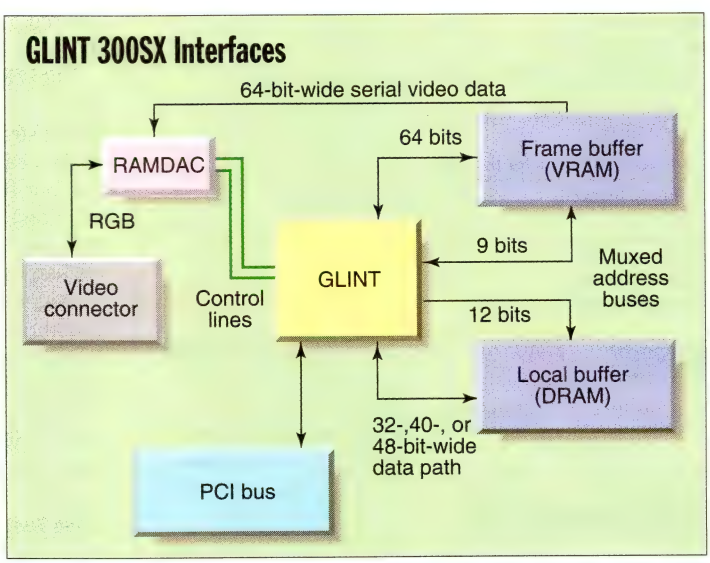
To do all this, GLINT uses two memory systems: a VRAM frame buffer that contains the actual pixel information, and a DRAM-based local buffer that contains the Z-buffer, alpha blending, and other 3-D housekeeping bits associated with each pixel in the display buffer.

Why So Many Pins?

The GLINT chip comes in a 304-pin package. It's a gate array made for 3Dlabs by IBM Microelectronics, and it looks similar to IBM's PowerPC 601 CPU. The size of the silicon die, however, is larger than that of the 601, and it has more transistors. One of the reasons there aren't too many good 3-D graphics display chips available is that, as the die size indicates, they tend to be pretty complex beasts. Luckily, despite its internal complexity, the GLINT hardware interface makes it really quite simple to integrate into a display system design.

As the figure "GLINT 300SX Interfaces" shows, in a typical GLINT display system, the chip can simultaneously access data from the PCI bus, a 64-bit-wide VRAM frame buffer memory, and a 48-bit-wide DRAM local buffer. Pins are also required to handle the VRAM and DRAM address buses.

The GLINT connects directly to the PCI bus, which



The GLINT as a video controller in a PCI-bus display board. Little glue logic is required to connect the chip to the PCI and RAM buses.

Circle 118 on Inquiry Card.

Make no mistake about it! The most fully-featured, automated data entry software is *now* the most accurate.

TELEFORM™ 4 WITH TRI-CR.

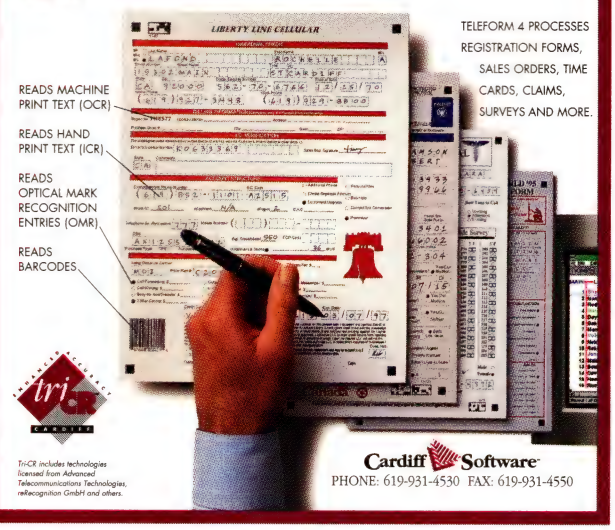
The technology behind our latest success story is Tri-CR. Our new powerful character recognition software provides you with even greater accuracy.

AUTOMATED DATA ENTRY.

ACCURACY FROM A TO Z.

Whether your forms contain hand print or machine print text, you're assured the highest level of accuracy available. What's more, it's affordable too. Teleform 4 with our new cutting-edge technology is just $1495. Call **800-659-8755** today to order or for more information.

Now Shipping Version 4.0



Tri-CR includes technologies licensed from Advanced Telecommunications Technologies, reRecognition GmbH and others.

Cardiff Software
PHONE: 619-931-4530 FAX: 619-931-4550

WELCOME TO YOUR NEXT "OPEN SYSTEMS" PLATFORM — MICROSOFT WINDOWS NT™!

FEATURED UNIX PRODUCTS FOR MICROSOFT WINDOWS NT FROM SOFTWAY AMERICA:

- **Hummingbird eXceed X for Windows NT** — $397
  Full featured X software for Windows NT
- **B&W Connect NFS for Windows NT** — from $359
  Client & server NFS solutions for NT
- **MKS Toolkit for Windows NT** — $199
  UNIX shell, commands & utilities for NT
- **Microsoft Windows NT 3.51 Workstation** — $299
  The new "Open Systems" workstation
- **Microsoft Windows NT 3.51 Server** — from $695
  The ultimate multi-OS server

Other great UNIX products for Intel PCs

- **UnixWare Personal Edition 2.01** — $289
  Desktop UNIX with graphics & networking
- **UnixWare Application Server 2.01** — $1,095
  Unlimited user UNIX with the "works"!
- **WordPerfect 6.0 for UnixWare** — $331
  State of the art graphical word processing for UNIX!

Microsoft SOLUTION PROVIDER

Novell Authorized OEM

Call for our complete list of UNIX products!

BONUS!!!

Order one of our products for Windows NT today and receive a FREE shareware and sampler CD-ROM containing the hottest UNIX & internet tools for Windows NT.

For years the UNIX™ system vendors have been trying to make UNIX and Windows work together on the same machine – without much luck. Now its our turn to show you how Windows NT can be your next integrated "Open Systems" platform.

Softway America is one of the world's leading suppliers of UNIX products for Intel-based platforms. We specialize in integrating UNIX tools and networking products with Microsoft Windows NT — tools to give you NFS client/server networking, X Windows, UNIX commands & utilities and full blown UNIX development environments. On top of that we offer great prices and support on all products and a no risk 30-day money back guarantee that makes us the place to come for UNIX products!

CALL NOW...

1-800-GET-UNIX

Softway America

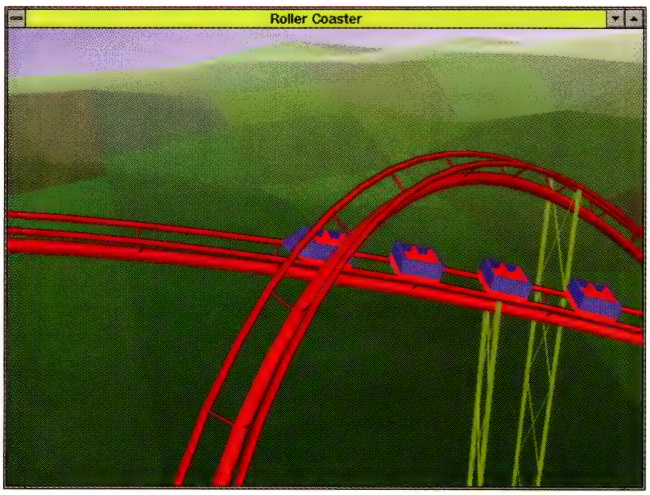
UNIX

- GREAT PRICES
- SERVICE & SUPPORT
- SATISFACTION GUARANTEED

Softway America Incorporated
P.O. Box 2821
Evergreen, Colorado 80437-2821
Phone: 303/670-5345
Facsimile: 303/727-7618
E-mail: sales@softway.com
WWW: http://www.softway.com/america

All registered trademarks and trademarks are the property of their respective owners.

CORE TECHNOLOGIES CPUs



The GLINT displaying a 3-D object with fogging, which enhances the illusion of depth.

eliminates the glue logic normally required to communicate to the bus. This also reduces a graphics board's component count and cost. The GLINT has an internally set PCI manufacturer's ID of 0x3d3d (clever—3Dlabs) and supports all the signals and registers defined in the PCI 2.0 standard. It has internal DMA, which allows either command or data blocks to be burst over the bus at around 20 MBps. This capability is important—without burst mode, you can get a data rate of only 3 to 8 MBps on a PCI bus.

Connecting VRAM and DRAM to the GLINT is very easy indeed. The address bus is internally multiplexed, so you can just connect the GLINT address pin through a damping resistor to the address lines on the memory. The control and data lines connect in the same way. Again, no glue logic is necessary.

When the GLINT powers up, it senses the state of some of the data lines (which are pulled either up or down by resistors) and configures its internal logic to address the amount of RAM present. It also automatically sizes the data bus widths (bus widths of 32, 48, or 64 bits are supported, depending on whether you're addressing DRAM or VRAM). This lets you customize the display system for the exact features you need. Once you've considered a few control lines and redundant power and ground lines, all 304 pins have been accounted for.

The VRAM has another 64-bit data bus, which passes the serial pixel data to a RAMDAC. The latter component assembles the 64-bit stream into pixels of different sizes. These 64-bit chunks of data can be modified to produce eight 8-bit (256 colors) pixels, four 16-bit (thousands of colors) pixels, or two 24-bit (millions of colors) pixels, as determined by the RAMDAC's display mode. This pixel bus operates at a maximum speed of 150 megapixels per second.

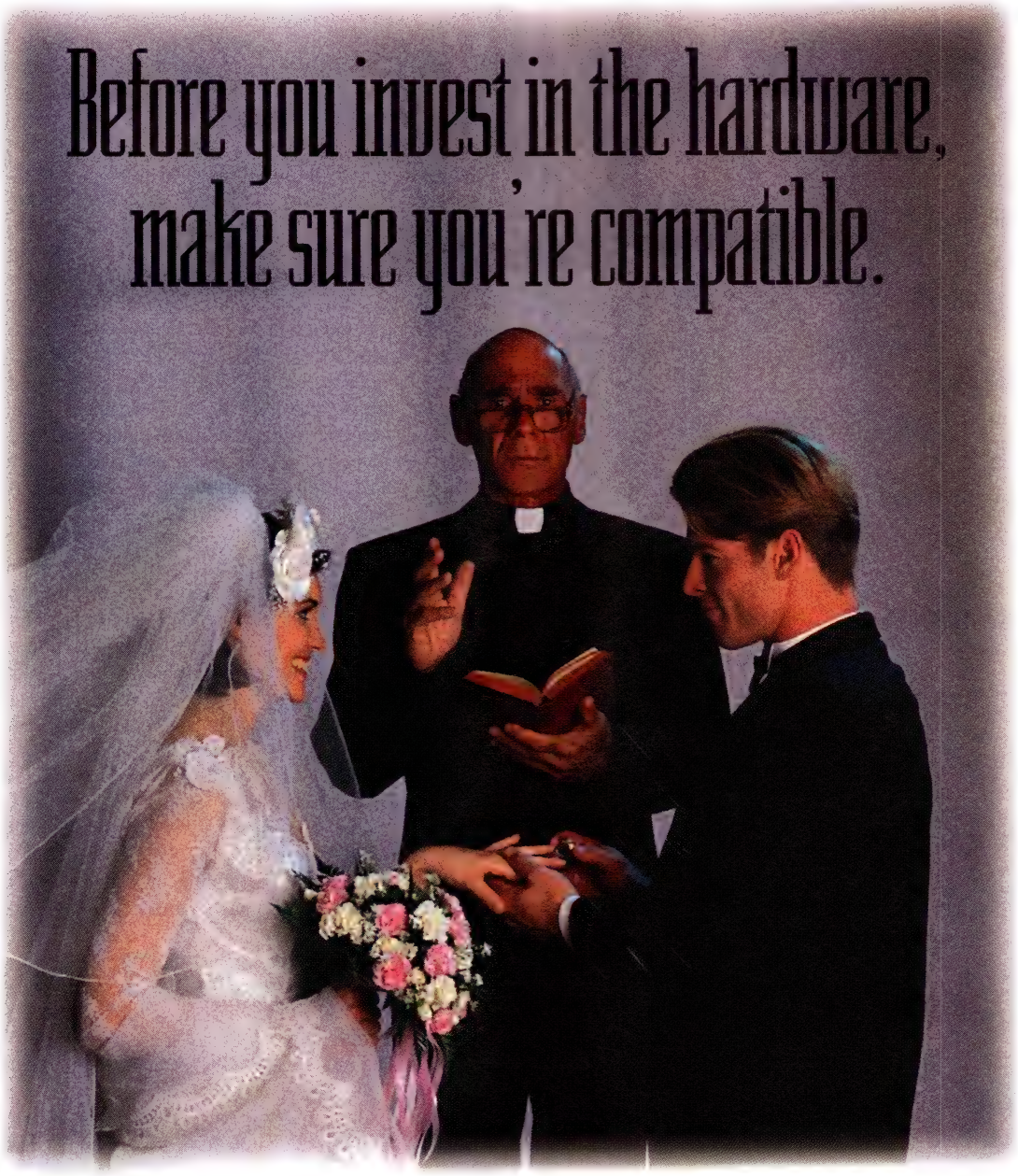
Having all these separate buses gives the GLINT massive processing power and throughput. It can be receiving a PCI command, writing a new pixel to the VRAM, and reading mask and Z-buffer information from the local DRAM, all during the same system cycle. It would not be possible to do these operations all at once with a general-purpose CPU, like the PowerPC 601, which handles only one 64-bit data access at a time.

Video Features

As important as throughput is to a display's performance, for 3-D imagery, additional image-processing capabilities are crucial for fast screen drawing. The GLINT provides hardware support

Circle 134 on Inquiry Card (RESELLERS: 135).

Before you invest in the hardware, make sure you're compatible.



Buying computer products is a major commitment. A commitment of time and money. So before you jump in with both feet, make sure the relationship is going to work. Look for the NSTL Seal.

National Software Testing Laboratories puts hardware and software through the most rigorous testing in the industry. Our exclusive compatibility tests, using real world equipment like yours, ensure that components will talk to each other, work together, get along great — or they can't carry the Seal. And that's true for everything from drivers and servers, to applications, adapters and printers.

MEETS TEST STANDARDS NSTL COMPATIBLE ®

For more information about the NSTL Seal or a list of manufacturers who have earned it, call 800-220-NSTL or 610-941-9600. Before you walk down the aisle.

Plymouth Corporate Center • 625 Ridge Pike • Conshohocken, PA 19428 • Fax: 610-941-9952 • NSTL is a division of McGraw-Hill, Inc.

Circle 83 on Inquiry Card.

MOVING?

To change your subscription mailing address, please complete the form below and send it to:

BYTE Magazine
Subscriber Services
PO Box 555
Hightstown NJ 08520

Fax: 609-426-7087
Phone (9 a.m. to 8 p.m., Eastern Time, Monday through Friday):
800-232-2983 (U.S.), or
609-426-7676

Current/Old Address:

Account Number

Name

Address

Company

City/State/Zip

New Address:

Name

Company

Address

City/State/Zip

Please allow up to 8 weeks for this change to become effective.

BYTE

A Division of The ***McGraw-Hill*** *Companies*

in a number of areas. Three worth mentioning in detail are antialiasing, color dithering, and screen-buffer clearing.

Antialiasing: This important graphics operation helps convince the eye that an image appears "real" and not computer-generated. When the display system draws a diagonal line, it does so by illuminating a set of pixels on the screen. The pixels in this line appear as discrete steps, particularly at the transition (or boundaries) between screen pixels. Antialiasing adds extra pixels to the line, which smoothes out these sharp boundaries.

The GLINT chip does this automatically by calculating the correct color and position for each pixel so that such boundary effects are minimized. The host software tells the GLINT to draw a line in 3-D space, and the GLINT draws it with depth perception and automatic antialiasing characteristics. This allows the applications software to operate purely in a fast vector-drawing mode. The screen at left shows a typical 3-D vector program whose output has been enhanced using the built-in antialiasing and fogging effects.

Color dithering: When it is shading a surface, the GLINT calculates all the pixels with 32-bit accuracy. Only at the end of the pipeline does it convert them to the 24-, 16-, or 8-bit color display modes. A dithering unit at the end of the graphics pipeline takes the 32-bit color value and tries to display it so that, even if only 256 colors are available on-screen, the eye interpolates between the different colored pixels and perceives an intermediate color value. The GLINT does this interpolation inside a 4- by 4-pixel matrix (16 pixels) with no speed penalty at all. Surprisingly, it works very well, assisted by the additional pixel-averaging effect of the shadow mask apertures on your CRT.

Clearing the screen buffer: The frame buffer VRAM has a built-in "fast clear" hardware mode that allows it to be cleared very quickly indeed. But in a 3-D graphics display system, it is also important to clear all the Z-buffer and alpha information in the DRAM local buffer.

However, DRAM does not have a fast-clear hardware capability. To clear it, you typically have to write a new value to every memory cell. This is not practical to do at the typical 30 frames per second necessary to achieve smooth motion in a 3-D display environment. So the GLINT Z-buffer has a feature called "fast clear."

Instead of clearing the entire Z-buffer on every frame, the GLINT divides the screen into 16 or 256 segments that get cleared only on sequential frames. The GLINT keeps track of which segments have been cleared, and if you are drawing into a section that hasn't been cleared recently, it uses a cleared pixel value when calculating the new Z-buffer value. Tag bits, kept in the local buffer DRAM memory, indicate whether or not a segment has been cleared.

The Future Is 3-D, but Faster

The GLINT is the first of a series of 3-D graphics controllers to come to market. While other manufacturers are producing similar chips that are less expensive, 3Dlabs is concentrating on building display controllers that define the state of the art for desktop graphics systems. Future versions of the GLINT chip will be able to directly handle texture mapping, and no doubt they'll run faster. ■

Trevor Marshall, a consulting editor for BYTE, is chairman of YARC Systems. John Davey is a project engineer at YARC Systems who has worked on a GLINT display board. They can be reached on the Internet at trevor@yarc.com and john@yarc.com, respectively.

BYTE WEARHOUSE

BYTE 20 Years 1975-1995

Celebrate BYTE's 20th Anniversary with Special Limited Edition Merchandise

All products are officially approved by BYTE.

MOCK TURTLENECK
Outer Banks 100% cotton mock turtleneck. White. Sizes M(BYT 4), L(BYT 5), XL(BYT 6). **$26.00**

INSIGNIA PEN
Parker Insignia ball point pen. Lacquer black. (BYT 9) **$34.50**

SWEATSHIRT
11 oz. cross grain Lee sweatshirt features generous athletic cut and side gussets. 95% cotton, 5% polyester. Ash. Sizes M(BYT 1), L(BYT 2), XL(BYT 3). **$31.00**

VECTOR PEN
Parker Vector Sport roller ball pen. Black. (BYT 10) **$6.25**

MOUSE PAD
Hard top mouse pad. 7.5"x 8.5". (BYT 7) **$5.25**

T-SHIRT
100% cotton Oneita Power-T. White. Sizes L(BYT 13), XL(BYT 14). **$8.00**

BASEBALL CAP
Soft brushed cotton free-form cap with adjustable Velcro closure back. Black. (BYT 11) **$10.00**

MUG
11oz. ceramic mug with logo on both sides. (BYT 8) **$4.50**

COMPUTER TOOL KIT
Deluxe computer device tool kit in black vinyl zipper case features: 2 nut drivers, 3-prong parts retriever, torx driver, IC extractor, 1 phillips and two slotted screwdrivers. (BYT 12) **$20.00**

Call 1-800-676-4256

or 1-708-647-4906 in Illinois, 8:30 a.m.-5:00 p.m. Central Time.
We accept VISA, MasterCard, American Express, and Discover.

Merchandise in stock will ship within 3 days of receipt. HA-LO notifies customers of out-of-stock items and gives the option to back order, substitute, or cancel the item. Sales tax additional where applicable. UPS ground shipping on domestic orders: up to $50 – add $5.75, $50 to $100 - add $7.75, over $100 – add 8%. Additional shipping charges apply to international orders.

UPGRADE TO RAID

Single or dual RAID controllers with optional automatic fail-over.

N+1 front removable load sharing power supplies dedicated to each RAID controller.

LCD panel and keypad for RAID status display and configuration.

True hot-plug drive modules from 500MB to 4.2GB.

Up to 33.6GB per (3u) EIA, modularly expandable.

Cold, warm or hot spare drives.

Up to 200GB of RAID in a 40" rack.

Optional Sphinx unit to rack-mount a desktop SPARC®, HP or SGI workstation for network addressable RAID.

Battery-backed audible and LED alarm indicator panel for power and temperature monitoring.

RAID levels 0, 3, or 5 with up to 28 drives, and 32MB cache per controller.

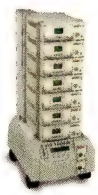
Individual, front removable, disk power supplies for further redundancy and fault tolerance.

LCD/keypad for disk information display and setting.

Complete flexibility in RAID set definition.

Lynx

LynxStak



LynxTower

LynxRack

Incrementally grow your system from desktop storage to RAID based on Lynx modules.

Without the Up-front Investment.

Artecon's new **LynxRAID™** enables you to upgrade from desktop mass storage to deskside or rackmounted RAID with 100% investment protection. With **LynxRAID**, you can incrementally grow into RAID by utilizing your existing Lynx desktop units and expanding your system as your needs grow.

Every Lynx subsystem features options such as true hot-plug drive modules from 500MB to 4.2GB, individual front removable power supplies and LCD/keypads. Lynx units can be stacked for desktop RAID or racked into a highly modular RAID system for maximum reliability and redundancy on SPARC®, HP, SGI, RS6000, Mac or PC platforms.

At the heart of each **LynxRAID** configuration is a fault-tolerant, RISC-based RAID controller subsystem, which occupies a mere 5.25" of vertical rack space and can support either one or two independent or dual loadsharing RAID controllers. Each controller is available with up to 32MB built-in cache, supports RAID levels 0, 3 and 5 and fast-narrow, fast-wide and fast-wide differential host interfaces.

The LCD panel and keypad give access to RAID status display and configuration. A battery-backed alarm panel provides both audible and LED alarm indication of potential voltage, current, temperature or controller failure.

In addition, each controller is equipped with two front removable loadsharing power supplies and removable fans for maximum fault tolerance. **LynxRAID** Towers can support up to 29GB of RAID storage each. Single controller **LynxRAID** rack configurations offer up to 100GB in a 40" rack, while dual controller systems can expand to 200GB in the same footprint.

So when you think about RAID, think about protecting your investment with a solution that grows with you. Call Artecon today for information on **LynxRAID** configurations.

1-800-USA-ARTE
1-800-872-2783

Enterprising solutions for your enterprise.™

Artecon™

PO Box 9000, Carlsbad, CA 92018-9000
(619)931-5500 FAX (619) 931-5527
email: sales@artecon.com
A Member of the Nordic Group of Companies

Artecon, Canada, (416) 487-7701 ▲ Artecon, Japan 81-3-3280-1210 ▲ Artecon, France 33-1-69-1818-50 ▲ Artecon, Europe 31-53-83-2209

Artecon and the Artecon logo are registered trademarks of Artecon, Inc. All other trademarks are proprietary to their respective manufacturers.

Circle 136 on Inquiry Card.

Weaving a Thread

Solaris and Windows NT both support powerful multithreading/multiprocessing to help get the job done faster

SHASHI PRASAD

A symmetric multiprocessor (SMP), also called a shared-memory multiprocessor, has multiple CPUs sharing a common memory space. This memory sharing allows a single copy of the OS to be running on all the processors. SMP machines promise higher performance and better scalability, but the OS software must be designed to support multiprocessing and also be tuned for a scalable and efficient SMP. The OS, by means of some application programming interface (API), should allow the application developer to split his or her program into multiple pieces and run them simultaneously.

Loose Threads

A sequential process has a single flow of control, a sequence of instructions executed by the process. In a multithreaded process, there are multiple schedulable flows of control called threads. Threads are associated with a sequence of instructions and are often referred to as "threads of execution." Threads support the notion of concurrent programming and are used to exploit the inherent hardware parallelism of the SMP machine. By splitting a problem into smaller pieces, a thread can run each piece concurrently on an SMP machine.

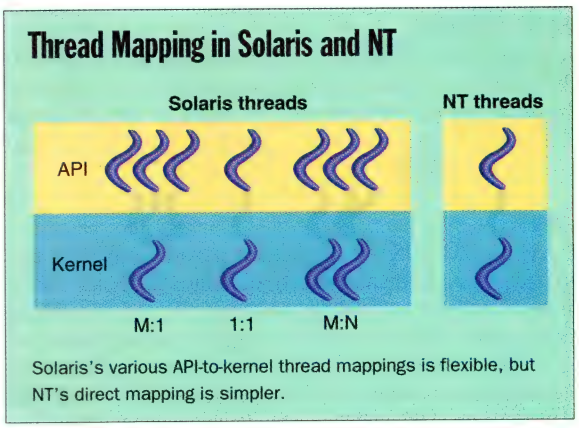
Traditionally, applications were split into multiple processes, and some form of interprocess communications (IPC) was used to communicate between the processes. A multithreaded process has more than one thread of control sharing both address space and resources. Using threads eliminates the need for any IPC and reduces context-switching overhead. Threads are also referred to as lightweight processes (LWPs), since the context maintained for threads is much lighter than processes. Even though threads are schedulable entities, it does not necessarily mean that they run in parallel. Threads can be scheduled concurrently on multiple processors, while on uniprocessor machines, threads are time-sliced.

With Solaris 2.2, Sun introduced a threads library for applications developers to take advantage of the multiprocessing and multithreading features of the advanced kernel. Solaris uses a two-tier thread library model. At the top layer are the user threads, and at the bottom layer are LWPs.

LWPs are kernel threads—they use kernel resources and are the actual schedulable entities in Solaris. The kernel is aware only of LWPs and knows nothing about user threads. The user threads are managed by the threads library, which supports one-to-one, many-to-many, or many-to-one mapping between the user threads and the LWPs (see the figure "Thread Mapping in Solaris and NT" below). The multiplexing of user threads to a pool of LWPs and the scheduling of user threads is handled by the threads library. Though the two-tier thread model adds some extra responsibility onto the user application, it allows for the cheap creation of user threads without using a lot of system resources.

Solaris has bound and unbound user threads. A bound thread is a one-to-one mapping between a user thread and an LWP. An unbound thread does not have a dedicated LWP; the threads library schedules the user thread on a pool of LWPs in a process. Applications that require global scheduling with respect to other LWPs in the system should use bound threads.

LWPs are scheduled by the kernel according to their scheduling class and priority. In Solaris, the process is created with an initial LWP, which inherits the scheduling class and priority of the parent process. Bound threads inherit the scheduling class and priority of the underlying LWP, while unbound threads inherit the scheduling class and priority of the process.



Solaris's various API-to-kernel thread mappings is flexible, but NT's direct mapping is simpler.

The Solaris kernel employs a preemptive priority-based scheduling system. LWPs of higher priority run before LWPs of lower priority. The Solaris threads library schedules user threads using priority levels on a pool of LWPs and chooses an LWP to execute user threads that are ready to run. If the LWP is blocked on an indefinite wait, the library saves the context of the blocked thread and assigns another thread to the LWP to run. The threads library usually creates enough LWPs to ensure that the process can proceed without an indefinite wait.

A Different Approach

Microsoft Windows NT was designed from the ground up to support multiprocessing and multithreading. Borrowing

from the ideas of object-oriented design, Windows NT uses object classes to represent the system resources. In NT, both processes and threads are represented as objects. Threads are the schedulable entities in NT; every process in NT must have at least one thread before it can execute. Unlike the Solaris two-tier thread model, NT uses a straightforward one-to-one mapping between a user thread object and a kernel thread object.

Threads have 32 different priority levels and are broadly classified into two classes: real-time and variable. Real-time threads in NT are always scheduled ahead of other threads in the system, and the NT kernel does not alter the priority of real-time threads. The thread dispatcher uses a preemptive priority scheduler, with the highest priority thread always scheduled to run.

Threads in the variable class have a base and a dynamic priority. The base priority of a thread ranges two levels above and below the process base priority. The kernel periodically adjusts a thread's dynamic priority. For example, when a thread waits on an I/O, the kernel raises the dynamic priority of that thread. Threads that are CPU-bound tend to have lower dynamic priorities, while I/O-bound threads tend to have higher dynamic priority. A thread's dynamic priority can never fall below the thread's base priority.

Thread Comparison

	Solaris	NT
Thread model	Two-tier	Direct
Posix thread API support	No (planned for 2.5)	No
Re-entrant OS libraries (i.e., thread-safe)	Yes (except for Motif/OpenLook)	Yes

Each process has a processor affinity, a set of processors on which the threads of that process can run. Processor affinity affects thread scheduling. The NT kernel first picks the highest priority thread and then determines if the thread can run on the processor. If it can't, the next highest priority thread on the processor is chosen to execute. NT, like Solaris, employs soft processor affinity such that it always tries to schedule a thread on the processor on which it last ran.

Threads API

In addition to the SMP OSes, both systems provide an API for creating and using threads in an application. Solaris's threads API is based on the Unix International threads interface, and support for the Posix threads interface is planned in the upcoming release of Solaris 2.5. The Solaris threads interface is very similar to the Posix interface, and applications developed using the threads API on Solaris can be easily ported to use the Posix interface. Windows NT does not support the Posix interface, and applications use the Win32 interface to develop multithreaded applications.

Any threads API can be broadly classified into such groups as thread management, thread synchronization, and thread-specific data. In both Solaris and NT, an initial thread is created when the process starts execution. Additional threads of control must be created by calling the thread-creation API. When a thread is created, it begins executing a start routine, and the new thread of control within the process is capable of independently being scheduled in both Solaris and Windows NT. Each newly created thread has its own stack, program counter, and a thread identifier. Thread identifiers in Windows NT are unique system-wide, while in Solaris they are guaranteed to be unique only within the context of the executing process.

Threads in a process exist in the same address space and share all the process resources, such as data variables, open file descriptors, and object handles. The sharing of data can be a blessing in disguise. Consider two threads in a multiprocessing environment concurrently updating a linked list. The results of such operations are undefined and can lead to data corruption. In a multithreaded program, any data that multiple threads can update simultaneously must be synchronized. Both Solaris and NT provide several thread-synchronization primitives.

Solaris and NT provide mutual exclusion, or mutex locks, to manage critical sections of the code. These mutex locks allow only one thread to execute the critical section of the code.

In multithreaded applications, it is common to divide the work between multiple threads. In such cases, one thread might have to wait for another thread to reach a particular state before proceeding. This form of synchronization is often called event synchronization. Solaris provides condition variables, while NT provides event objects for interthread synchronization.

In addition to mutexes and condition variables, Solaris provides semaphores and reader/writer locks for thread synchronization. Some of the other synchronization primitives in NT are critical section objects, semaphores, and I/O completion ports. The synchronization APIs on NT offer better functionality than those on Solaris and, except for critical section objects, provide the same APIs for process and thread synchronization. Though both OSes provide the basic functions for thread programming, the Posix threads interface provides much more advanced features than does the Win32 interface.

Developing multithreaded applications also requires an environment that supports multithreading. Solaris provides re-entrant versions for most of the commonly used libraries. Currently, Solaris does not provide thread-safe versions for Motif and OpenLook libraries, which are rarely used by multiple threads in a program. Windows NT also provides re-entrant versions for most of its commonly used libraries.

Debugging multithreaded applications is a big challenge and could be frustrating without the support of a thread-aware debugger. Solaris supports a multithreaded debugger as a part of SPARCworks/iMPact, while Microsoft supports a multithreaded NT debugger as part of Visual C++. In addition to showing all threads of a process, both debuggers support suspending and resuming threads and inspecting variables on a per-thread basis.

The structured exception-handling (SEH) feature of Windows NT aids in the development of robust multithreaded applications. Terminating threads can always release held resources before exiting on exceptions, thus avoiding indefinite postponement. The exception-handling features of Windows NT are not language-specific.

Multithreaded Future

Solaris and Windows NT provide good environments for the development of multithreaded applications. They are by no means the only multithreaded OSes available at the desktop. NextStep, AIX (and other Unixes), and OS/2 provide thread support, as does Windows 95. Future versions of the Macintosh OS will also go threaded. The increasing availability of multiprocessor hardware and the improved responsiveness realized even on uniprocessor machines means multithreaded applications are here to stay. ■

Shashi Prasad is vice president of ANSTEC Technologies, a systems integration and consulting firm in Somerset, New Jersey. He is the author of an upcoming book (spring 1996) from McGraw-Hill on multithreading programming techniques, covering multiple OSes. You can reach him on the Internet at shaship@anstec.com or on BIX at editors@bix.com.

integrix®

NOW YOU CAN

IGS5™
IGS20E™

Internet Gateway Servers

Integrix Internet Gateway Servers

provide PC, Macintosh and workstation users an easy and affordable way to cast their nets into cyberspace, with complete pre-configured solutions.

Open Your Mind

The IGS includes a host of features and utilities to put you just a few clicks from the Internet.

Easy Access - Turnkey Operation

The unique, fully integrated design ensures ease of use, power, and expandability. So, what can it do for you?

Mosaic - the "killer application" of the 90's, a point and click graphical interface that gives you access to the internet's vast pool of information.

Firewall security - a combination of security programs that control traffic in and out of your local network, preventing unauthorized access.

POP3 Mail Server & Eudora - delivers email between your desktop and the rest of the world through an intuitive, easy to use interface.

SLIP/PPP, ISDN, and T1 (optional) Interface - multiple possibilities for connecting the system to the internet; from low-cost SLIP/PPP dialup to a direct, high-speed T1 line.

WAIS - libraries of knowledge can be accessed through a powerful search utility.

TCP/IP - every machine on your network gets as much or as little internet capability as needed.

Flexibility Built-In

Two models running under Solaris™1 are available.

The IGS 5/85 has an 85 MHz microSPARC™ processor, five SBus slots and supports 10 to 50 users.

The IGS 20E™ has a 75 MHz SuperSPARC™ or HyperSPARC™ processor, with room for up to four CPUs that can support 300 users. Provides a built-in ISDN interface.

Value Extends Beyond Price

Integrix innovation, reliability and award-winning designs are always at work for you. And, all this attention to detail and quality comes at a cost significantly lower than that of the competition.

Technical Smarts

We are committed to provide you with custom, ready to go systems. Explore your options - servers, workstations, graphics boards, RAID - for your site. For fast, personalized service, call us.

integrix®

Corporate Headquarters
1200 Lawrence Drive, Suite 150
Newbury Park, California 91230
Tel: 800-300-8288 / 805-375-1055
Fax: 805-375-2799
Email: sales@integrix.com

Asia
Beijing, P.R.China
Tel: 861-257-0018
Fax: 861-253-5306
Seoul, Korea
Tel: 2-515-5303
Fax: 2-515-5302

© 1995 Integrix. Inc. Integrix and the Integrix logo are registered trademarks and IGS, SEC, SGX, TGX, SWS and SSC are trademarks of Integrix, Inc. All other trademarks mentioned are the property of their respective companies. Manufactured in USA. Internationally supported.

Circle 73 on Inquiry Card.

Mac-to-UNIX solutions from AGE. Connectivity to the Core.

Hungry for access to a wider range of resources? With PacerShare® you can serve up any file on your UNIX network — quickly, easily and securely — to both your Macs and PowerMacs. Need terminal emulation? Open up to the wide world of PacerTerm®, with multi-window, multi-session, multi-protocol VT420 emulation. Or sink your teeth into X windows with XoftWare® for Mac™ OS, part of our complete line of cross-platform X server solutions. You can also add printer sharing (PacerPrint) and database access (OBDC and DAL) for a completely integrated Mac-to-UNIX solution. So conduct your own taste test! Just call us at **1-800-PICK-AGE** (1-800-742-5243) or e-mail us at sales@age.com for your special introductory copy of PacerTerm or XoftWare for Mac OS.

$99
1ST-TIME OFFER

age

AGE Logic, Inc. 12651 High Bluff Drive, San Diego, CA 92130
Tel: 619.755.1000 Toll Free: 1.800.742.5243 East Coast: 1.800.722.3702
Fax: 619.755.3998 e-mail: sales@age.com Internet: http://www.age.com

Pacer Products

PacerTerm, PacerShare and XoftWare are registered trademarks of AGE Logic, Inc.
All other trademarks are the property of their respective owners.

Circle 119 on Inquiry Card (RESELLERS: 120).

The Standard Template Library

Part of the draft C++ standard, STL provides the framework for building generic, highly reusable algorithms and data structures

ALEXANDER STEPANOV

In every programming language, there's a need for various data structures, such as vectors, lists, and associative arrays. Programmers also need fundamental algorithms—for sorting, searching, and copying—defined for the data structures. It has long been lamented that C++ doesn't provide a good set of standard data structures.

But at last this problem has been remedied. The Standard Template Library is a framework of data structures (called *containers* in STL) and algorithms accepted as part of the draft C++ standard. A reference implementation of STL has been put into the public domain by Hewlett-Packard (it can be downloaded from butler.hpl.hp.com), and a growing number of commercial vendors are now shipping STL.

In the short time since its release, STL has generated many emotional—and conflicting—assessments. On one hand, for example, Bjarne Stroustrup of Bell Laboratories calls it a "large, systematic, clean, formally sound, comprehensible, elegant, and efficient framework." On the other hand, Pamela Seymour of Leiden University writes that "STL looks like the machine language macro library of an anally retentive assembly language programmer."

Goal: Generality + Efficiency

STL is not an attempt to impose yet another standard on a suffering humanity. And it was not designed by or for a committee. It is the result of over 15 years of research in generic programming that I've done in different places, with different collaborators, and in different programming languages. I did this research with a concrete goal in mind: to find a way to write algorithms in the most general way, but in such a way that their abstractness would not impose any performance penalty.

What do I mean by "in the most general way"? Simply that an algorithm works on all data types for which it makes sense. For example, a linear-search algorithm is written in the most general way if it can search any data structure for which the operations of looking at data, going to the next data element, and indicating the end of the search range are defined. So, it should work for an array, a singly linked list, a doubly linked list, a file, and even a binary tree.

An algorithm should also work for portions of such structures. For example, you might want to search half a list or sum the set of elements in an array that are *n* spaces apart (i.e., a stride).

What do I mean when I say that an algorithm does not "impose any performance penalty"? In other words, how do you know that a generic algorithm is efficient? An algorithm is called *relatively efficient* if it's as efficient as a nongeneric version written in the same language, and it's called *absolutely efficient* if it's as efficient as a nongeneric assembly language version.

For many years, I tried to achieve relative efficiency in more advanced languages (e.g., Ada and Scheme) but failed. My generic versions of even simple algorithms were not able to compete with built-in primitives. But in C++ I was finally able to not only accomplish relative efficiency but come very close to the more ambitious goal of absolute efficiency. To verify this, I spent countless hours looking at the assembly code generated by different compilers on different architectures.

I found that efficiency and generality were *not* mutually exclusive. In fact, quite the reverse is true. If a component is not efficient enough, it usually means that it's not abstract enough. This is because efficiency and abstractness both require a clean, orthogonal design. A similar phenomenon occurs in mathematics: Making a proof more abstract makes it more concise and elegant.

Orthogonal Component Space

The past 25 years have seen attempts to revolutionize programming by reducing all programs to a single conceptual primitive. Functional programming, for example, made everything into a function; the notions of states, addresses, and side effects were taboo. Then, with the advent of object-oriented programming (OOP), functions became taboo; everything became an object (with a state).

STL is heavily influenced by both functional programming and OOP. But it's not a single-paradigm library; rather, it's a library for general-purpose programming of von Neumann computers.

STL is based on an orthogonal decomposition of component space. For example, an array and a binary search should not be reduced to a single, fundamental notion.

Printing Names of Productive Employees

```
vector<Employee> all;
bool is_manager(const Employee& x) {
        return x.title == "manager"  }
...
remove_copy_if(
  all.begin(),
  all.end(),
  ostream_iterator<Employee>(cout),
  is_manager);
```

The two are quite different. An *array* is a data structure—a component that holds data. A *binary search* is an algorithm—a component that performs a computation on data stored in a data structure. As long as a data structure provides an adequate access method, you can use the binary-search algorithm on it. Only by respecting the fundamental differences of arrays and binary searches can efficiency and elegance be simultaneously achieved.

Iterators

The key to STL is the notion of *iterators*, which are generalized pointers that provide a glue for connecting algorithms and data structures. STL is indeed retrograde in its disregard of the current academic dogma suggesting that pointers are evil. Instead of hiding pointers behind value semantics, it makes them the cornerstone of the design. The decision to bring pointers back into the realm of respectability was based on a simple fact: Most things in programming resemble pointers in that they identify a location of data. For instance, Internet addresses, SCSI addresses, and file descriptors all function as pointers.

An STL Implementation of remove_copy_if( )

```
template <class InputIterator, class OutputIterator, class Predicate>
OutputIterator remove_copy_if(InputIterator first, InputIterator last,
                              OutputIterator result, Predicate pred)  {
   while (first != last)  {
       if (!prod(*first)) *result++ = *first;
       ++ first;  }
   return result;  }
```

Consider the task of printing a list of productive employees (see the listing "Printing Names of Productive Employees"on page 177). The employees' names are stored in a *vector*, an STL version of a one-dimensional dynamic array. To print the names of productive employees, you use the STL function `remove_copy_if()`, which scans the range of elements from its first argument up to, but not including, its second argument and copies those that do not satisfy a predicate (its fourth argument) into positions starting from its third argument. (For most people, the code is clearer than the explanation.) The functions `begin()` and `end()` return iterators pointing to the first element and past the last element in the vector, respectively. (STL requires that for every container, the number of valid iterators pointing to it is one greater than the number of elements in the container.) The STL component `ostream_iterator` provides an iterator-like interface to an output stream.

It's important to note that if you later decide to put employees' names in a list instead of in a vector, you do not have to change anything except the declaration of the variable `all`. The `remove_copy_if()` function works for vectors, lists, deques, and sets (which are all STL components), as well as for any user-defined container that provides STL-conforming iterators. It also works for regular C arrays.

Iterator Categories

STL classifies iterators into five categories: input, output, forward, bidirectional, and random-access. These iterator categories are sets of requirements for operations that are supported by concrete iterator types. An important experimental discovery I made was that hundreds of different practical algorithms can be written in terms of these abstract categories.

STL specifies a set of valid expressions for each category's iterators, as well as precise semantics for each iterator's usage. For example, given that `i` is a value of a type that belongs to a bidirectional iterator category, if `++i` is defined, then `--(++i) == i`. STL also prescribes certain complexity requirements for these expressions. Users are thereby guaranteed that algorithms written in terms of these abstract interfaces will work effectively.

Different algorithms require different kinds of iterators, and different algorithms are needed to perform different operations on different data structures. STL uses a novel language technique that selects the right algorithm at compile time, depending on the iterator category.

Generic Algorithms

The listing "An STL Implementation of `remove_copy_if()`" illustrates how STL deals with iterators. What's most striking is the fact that it looks just like regular C code; only the signature is different. In fact, I've found that C programmers find it quite easy to start programming in STL even when they don't know C++, because the underlying idioms are already familiar to them. The fact that all the iterator categories are abstracted from pointers ensures that there is an efficient implementation for them.

In computer science it's important to base abstractions on efficient models. In other words, I believe that `remove_copy_if()` is efficient because it generates good code when used with plain C arrays. In fact, if you use `remove_copy_if()` with STL function objects rather than with pointers to functions, as I did in the listing "Printing Names of Productive Employees," you can obtain code that is often just as efficient as hand-written assembly code.

The Future

It is my hope that STL will prove to be the beginning of a long process of developing systematic catalogs of highly parameterized software components. The ANSI/ISO C++ standard committee saw the promise of STL and provided a conduit through which generic programming could reach working programmers.

I'd like to use this opportunity to advocate the creation of an industrywide consortium for developing new generic components. No single company can accumulate the algorithmic expertise that is needed for such an activity. And it is in everybody's interest that all the fundamental algorithms and data structures be universally and inexpensively available. ■

ACKNOWLEDGMENTS

I would like to express my gratitude to Bjarne Stroustrup, Ross Towle, Jim Dehnert, Suresh Srinivas, Mary Loomis, and Larry Rosler for reviewing this article.

Alexander Stepanov is a member of the technical staff at Silicon Graphics, Inc. (Mountain View, CA), where he works on C++ libraries and tools. Prior to joining SGI, he worked for HP Labs, AT&T Bell Labs, Polytechnic University (Brooklyn, NY), and GE R&D. He has worked in such areas as generic software libraries, storage systems, OSes, compilers, and path-planning algorithms for robots. He can be contacted on the Internet at stepanov@mti.sgi.com or on BIX c/o "editors."

Internet Firewalls

The demand for good Internet firewalls is spurred by the growing number of intrusion incidents

STEPHEN COBB

With new connections to the Internet appearing at the rate of 1 million per month, internetworking may be the biggest revolution in computing since personal computers. But changes of this magnitude often create problems. It's no secret that the rate at which Internet connections are being hacked, cracked, or otherwise compromised is also growing at an alarming rate.

That has caused many companies to look to Internet firewall technology to protect their network resources. However, many companies, when searching for solutions, are finding that they are stymied by a lack of common definitions for key firewall functions. This makes it difficult to tell what functions you are paying for and makes comparisons of similar products impossible.

The National Computer Security Association (NCSA), an independent security association, is trying to bring some order to the confusion created by marketing hype. The NCSA has formed a group called the Firewall Product Developers' (FWPD) consortium. It brings together leading vendors of firewall products in an effort to address such common issues as customer education, standards, product testing, research, and certification.

The FWPD consortium is similar in structure to the Anti-Virus Product Developers' (AVPD) consortium, which was founded by the NCSA in 1991. That group, which included virtually all the major antivirus product vendors, helped clear up the confusion in the antivirus market. For example, the AVPD consortium agreed to use a common naming scheme for viruses. All vendors counted the number of viruses their products detected in the same way, letting customers easily compare products. The FWPD consortium seeks to do the same thing for firewalls.

Meeting a Need

The demand for good Internet firewalls is spurred by the growing number of intrusion incidents. The number of violations reported to the Computer Emergency Response Team (CERT) in 1990 was 130. That number increased to 2300 in 1994.

People involved in these incidents are not just kids getting their kicks with modems. Systematic and automated probing of new Internet connections is being carried out by a shady cast of characters that includes hackers-for-hire, information brokers, and foreign governments. Katherine Hutchison, director of secure business for Harris Computer Systems, points out that computer crackers gained unauthorized access through the Internet in more than 80 percent of the computer crimes investigated by the FBI.

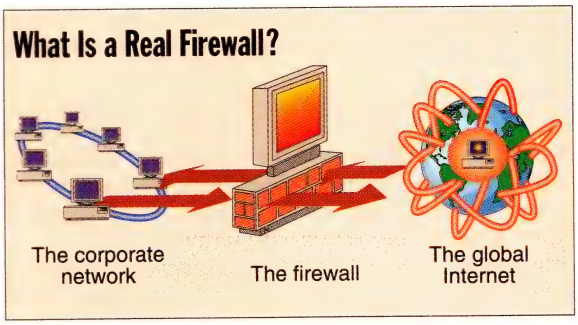
Fortunately, network administrators can avail themselves of some effective countermeasures, notably firewalls. A firewall can be defined as a collection of systems, routers, and policy placed at a site's central connection to a network. This definition comes from the paper "Keeping Your Site Comfortably Secure," an excellent introduction to Internet firewalls from the National Institute of Standards and Technology (NIST Special Publication 800-10). It can be downloaded free of charge from the NIST World Wide Web site (http://www.nist.gov), as well as from sources such as the NCSA InfoSecurity Forum on CompuServe (type GO NCSA to get to the forum).

According to Rich Kosinski, president of Internet Security (Lexington, MA), a firewall is a form of access-control technology that prevents unauthorized access to information resources by placing a barrier between an organization's network and an unsecured network (see the figure "What Is a Real Firewall?"). You can also use a firewall to prevent the unauthorized export of proprietary information from a corporate network. In other words, a firewall functions as a gateway, controlling traffic in both directions.

The Firewall Dilemma

Firewalls have been called condoms for corporate networks. They provide digital protection for participants in the packet-level intercourse associated with the rapid growth of internetworking and commercialization of the Internet. As with condoms, many people have heard of firewalls, and some people use them. However, the number of security incidents arising from Internet connections strongly suggests that not enough people are using them properly.

continued



The Firewall Product Developers' consortium is working toward a common language that will let users better understand and compare firewall implementations.

You might think this is a no-brainer: If you can't make a safe connection to the Internet without a firewall, you get one or you don't connect. But both of these options are fraught with problems. The current level of information-superhighway hype is so intense that network managers who don't provide users with Internet services are likely to find users doing it for themselves.

"Users buy a $100 modem with petty cash, plug it into a PC on the network, and, since our machines are already running TCP/IP, just turn on SLIP or PPP and dial out to a local service provider," says one network manager (who preferred to remain anonymous) at a major automobile plant. "What these users don't realize is, they have just made the company network part of the Internet."

If you decide to take the preferred approach, an officially sanctioned and properly managed Internet connection, you will find that installing a firewall is several orders of complexity beyond plugging in a modem or configuring NetWare directory access rights. For a start, you have to decide whether to build your own firewall (perhaps using a router and one of the available toolkits), buy an off-the-shelf product, or budget for a specialized firewall consultancy.

Next, you have to decide what type of firewall you want. Do you want a packet filtering router, a dual-homed gateway, a screened or bastion host, or a screened subnetwork? Do you want to integrate a modem pool while you're at it? Are you going to run the firewall software on Unix or under Windows NT? What sort of access controls will you place on the host to prevent internal tampering with the firewall settings?

Where to Find

For more information about the Firewall Product Developers' consortium, contact:

National Computer Security Association
10 South Courthouse Ave.
Carlisle, PA 17013
(800) 488-4595
(717) 258-1816
firewall@ncsa.com

When you look at the current offerings in the marketplace, you see a wide range of prices, from tens of thousands of dollars down to a few hundred dollars. You may wonder what could possibly make the top-end product worth so much more than the bottom-end product. This is where customer education is critical. Most vendors will gladly supply you with white papers and briefings, point you to Web sites, and otherwise assist you in understanding their product.

However, you may well discover that one vendor's definitions are not consistent with another's. That can cause much confusion. In fact, the lack of a standard terminology with which to describe this rapidly evolving technology means that you will probably have difficulty reaching the decisions required to successfully implement a firewall, causing further delays.

Unfortunately, the lack of a common vocabulary, combined with the urgent need for protection, is being exploited by unscrupulous vendors. Some vendors have slapped the word *firewall* on products that do not measure up to the NIST definition given earlier. If a firewall is not installed properly, it could be worse than not having one due to a false sense of security.

MEMBERS OF THE FIREWALL PRODUCT DEVELOPERS' CONSORTIUM

(For information about each organization's efforts, send E-mail to the address listed.)

ANS CO+RE Systems, Inc.	interlock@ans.net
Atlantic Systems Group	sales@asg.com
CheckPoint Software Technologies	shlomo@CheckPoint.com
Digital Equipment Corp.	kaiden@ljo.dec.com
Harris Computer Systems Corp.	Cyberguard@mail.hcsc.com
IBM	peter_crotty@vnet.ibm.com
Internet Security	info@security.com
National Institute of Standards and Technology	aldridge@csmes.ncsl.nist.gov
Network Systems	pjjpayack@network.com
Raptor Systems	smcconnon@raptor.com
Telos	michael.lazar@telos.com
Trusted Information Systems	gauntlet-info@tis.com

Some Relief in Sight

This is where the FWPD consortium comes in. It was formed in June by a group of vendors and several security agencies (see the table). The FWPD wants to foster codes of practice for the industry. "The FWPD will promote awareness and understanding of firewalls, explore product certification and testing, and serve as an authoritative but independent contact point for inquiries about firewall technology," says Peter Tippett, president of the NCSA.

Tippett describes the public information role as countering the media hype and being the voice of calm. To provide the necessary depth of knowledge in firewall technology, the NCSA has formed a strategic partnership with Marcus Ranum. Head of Information Works, Ranum is well known for his seminal 1992 paper "Thinking About Firewalls." Ranum also designed the TIS Internet Firewall Toolkit, which forms the basis of more than a dozen commercial products.

Noting that many firewall product descriptions use similar jargon in dissimilar ways, Ranum proposed, and the inaugural meeting of the FWPD agreed, that the first order of business should be to develop a common language for talking about firewalls. As a starting point, Ranum presented a draft version of the Firewall Product Functional Summary, a standardized format in which vendors can describe the distinguishing features and advantages of their products. The Summary's second major purpose is to give users a way to compare and contrast the features and design principles of firewall products.

The goal of the Firewall Product Functional Summary is to provide plenty of scope for vendors to present the strengths and advantages of their particular offerings, but in a way that has some real meaning to users. The document can be accessed via the Web at http://iwi.com or by sending an E-mail message to firewall@ncsa.com.

Beyond Standards

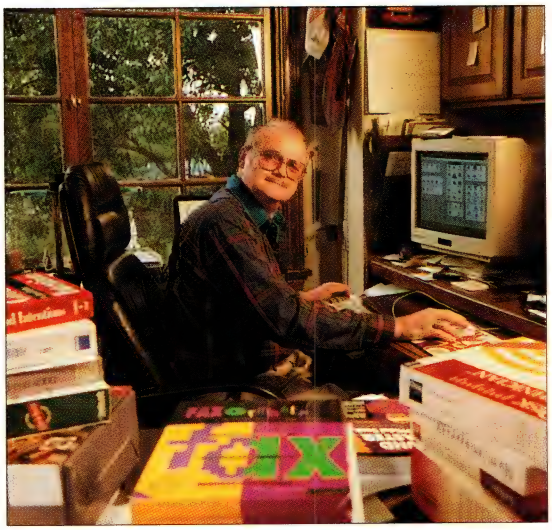
The FWPD is not "yet another standards committee," says Bob Bales, executive director of the NCSA. Noting that the industry already has appropriate committees, such as ANSI, for setting standards in areas such as firewall-to-firewall encryption, Bales says that the goals of the FWPD are more in the direction of customer education and industry self-regulation.

"The bottom line is getting more people to use more firewalls more effectively," says Bales. The formation of the FWPD means that the people who need firewalls and the people who make them will be able to work together more effectively to better defend the network systems upon which we all increasingly rely. ■

The author of more than 20 books and hundreds of articles on computing, Stephen Cobb is director of special projects for the NCSA and cochair of the Computer Ethics and Responsibilities Campaign. His latest book, The NCSA Guide to PC and LAN Security, *will be published by McGraw-Hill later this year. He can be contacted at scobb@ncsa.com.*

JERRY POURNELLE

Death Swoops and Upgrades



AMY ETRA © 1995

From a spacecraft to hardware and software upgrades, Dr. Pournelle's explorations into the unknown continue on all frontiers

I'm just back from watching the DC/X do a perfect death swoop, and maybe I'd better explain that. The DC/X is a one-third scale model of a single-stage-to-orbit (SSTO) spacecraft. Back in 1989, Max Hunter, General Daniel Graham, and I convinced the National Space Council to investigate the SSTO concept, and the DC/X was one result. If you see it fly, it's unforgettable: it goes straight up, hovers, and lands on a tail of fire.

One design for a full-size SSTO spacecraft reenters nose first, meaning that somewhere in the flight it must rotate to tail down. That's a dangerous maneuver that's become known as the death swoop, but yesterday's flight went so well it was almost dull.

There was one glitch. The radar altimeter gave a false reading, and the flight-control software, which thinks this is a very odd F-15 flying an even odder flight profile, believed the reading. Thus, the ship came down fast and landed harder than she was supposed to, crushing some nonresilient shock-absorbing material. That's what's supposed to happen in a hard landing, and the crushables are designed to be field-replaceable, so you can count this another successful test.

Meanwhile, we've been upgrading both hardware and software at Chaos Manor. As usual, things didn't go quite as planned, so we learned a lot.

The first upgrade was installing OS/2 Warp Connect on Valiant, the ValuePoint Pentium. Installing OS/2 has been so difficult that I expected more trouble with Warp Connect than I had. Still, I had enough problems that I kept IBM technical experts Sam Detweiler and Charlie Brown on the phone for 3 hours.

IBM has been listening: OS/2 Warp Connect's installation program is a lot better than previous OS/2 installation programs. Installing it on Percy, the IBM PS/2 Model 77, went without a hitch. Percy had been running Blue Label Warp, meaning that it has Win-OS/2 built in. Alas, Valiant was running Red Label Warp—which requires your own DOS and Windows—and OS/2 Warp Connect is Blue Label. An additional problem was that I was using OS/2 LAN Server with the older Warp. You can't install Warp Connect over that. Fortunately, it uninstalls itself easily.

Before it was over, I learned more about editing an OS/2 CONFIG.SYS file than I wanted. Although I was talking to system programmers, standard IBM technical support is quite good. If you're determined to get Warp Connect installed, they'll work with you until you manage it. One detail is significant: when you do get it installed, turn off your computer before you bring it up for the last time.

When you get OS/2 Warp Connect running, you'll like it. It retains one major design defect. Whereas Windows and Windows 95 (W95) trap Ctrl-Alt-Del and let you use that to shut down a nonresponding window, all flavors of OS/2 commit suicide when receiving Ctrl-Alt-Del. While it's rare to get an application so fouled up that Ctrl-Escape won't return to the OS/2 desktop, it can happen with both DOS and Windows programs running in an OS/2 environment. It's most

ILLUSTRATIONS: MARK FISHER © 1995

American Made Steel Chassis

Computer or RAID Applications

- Rugged all-steel construction
- Designed for FCC certification
- Easy assembly and service
- Full line of models and sizes
- Competitive prices
- American made redundant power supplies, removable disk drive modules, RAID controllers, Passive Back Planes in stock!

Call ***NOW*** for information and ***FREE*** color catalog

1-800-394-4122

VISA & MasterCard accepted
Same day shipment!

Designed, Manufactured, Guaranteed by:

CALIFORNIA PC PRODUCTS

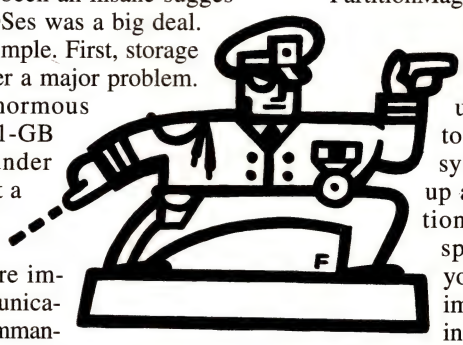
408-638-9460
205 Apollo Way - Hollister, CA 95023

Circle 127 on Inquiry Card.

likely when testing new software. It's extremely likely if you run a DOS game inside Windows inside OS/2. Also, I can reliably crash OS/2 by being careless with the reply editor in Norton Commander's MCI Mail Manager.

With that exception, I've found OS/2 Warp Connect as solid as a rock. It's fast. It networks to itself, Windows for Workgroups, and W95 with no problems. It does reliable multitasking. It prints so well that I've connected the Hewlett-Packard LaserJet III to Valiant and do all my printing across the network. The package includes an astonishing amount of useful and solid software, including communications software that makes Internet surfing almost trivially simple.

OS/2 is neat. Why not try it? A year ago, that would have been an insane suggestion: changing OSes was a big deal. Now it's fairly simple. First, storage space is no longer a major problem. You can buy enormous hard drives—a 1-GB IDE drive is under $300, and we got a 3-GB SCSI drive for under $800. Second, and more important,V Communications' System Commander lets you change OSes more easily than you used to be able to change CONFIG.SYS and AUTOEXEC.BAT.



System Commander is a blooming miracle. It's simple to install, and once installed, it's easy to add OSes. The instructions are complete, and the documents are a decent guide to configuring OSes.

You install System Commander under DOS. If you're putting it on an OS/2 machine, you dual-boot back to DOS and install it there, after which System Commander will operate exactly as OS/2 Boot Manager, whether you installed Boot Manager or not. Once you have System Commander installed, you can add OSes to your heart's content. I'm seriously thinking of setting up a machine with Blue and Red Label Warp; DOS 3.x, 5.x, and 6.x; Novell DOS 7; NT; W95; Linux; and SCO Unix. That may be going a bit far, but it's possible.

Some installations can be a bit tricky, and you'll want to read the documents carefully. For instance, if you already have W95 installed, you must save some files in a temporary place, boot up with a DOS disk, install System Commander, reboot W95, reboot from a DOS disk, SYS the hard disk with DOS, and reboot one more time. At this point, you'll have your choice of booting with DOS or W95. You can then add other OSes.

Highly recommended for anyone who likes to experiment.

PowerQuest's PartitionMagic works with System Commander, and it's recommended in the System Commander manual. While System Commander lets you change OSes without reformatting and losing your data, PartitionMagic lets you decide how much of your hard drive you want to devote to each OS. You can change those allocations on the fly. If you want to experiment with OS/2's High Performance File System (HPFS), this is a painless way to try it.

The version I have says "For OS/2," but in fact it includes a version that runs just fine under DOS. You can use DOS PartitionMagic to create a new logical drive for OS/2 and other OSes. You can then use System Commander to choose among those systems when you boot up and finally use PartitionMagic to reallocate space to them after you've done your experiments—all without losing data. Of course, you should back up everything before trying this.

Installing and using PartitionMagic is easy, and the instructions are clear and complete. If you get System Commander, you'll almost certainly want this, too. Highly recommended.

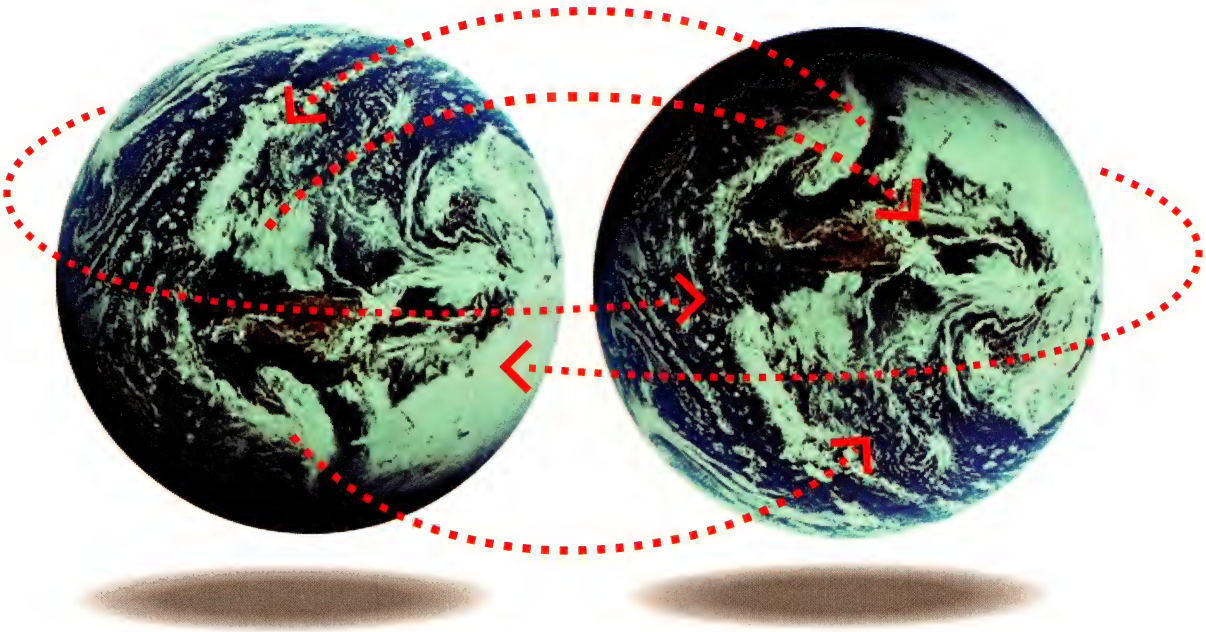
Before you upgrade, you must back up your system. You should know about SnapBack, which may be the ultimate in backup programs.

My regular backup system remains Palindrome's Network Archivist with a digital audiotape (DAT) drive. I have used it for years both locally and over a network, and I have never lost a byte of data protected by it.

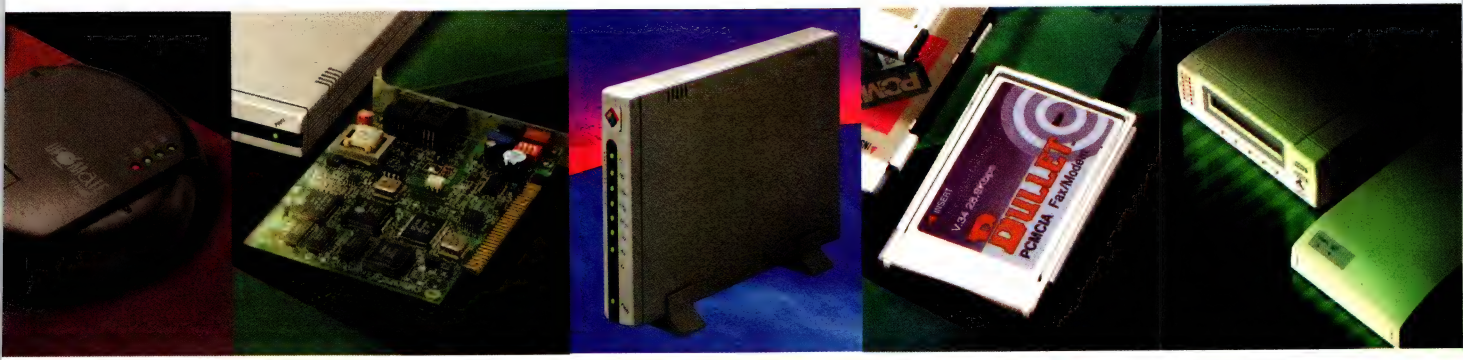
Network Archivist is great for recovering lost files, and its library management guards against operator errors. I wouldn't want to be without it; but using it to restore whole volumes can be complicated, and it doesn't do anything to restore the boot sectors of an OS.

For that you need SnapBack, which builds up a "below-the-OS" low-level image of any drive or drive partition. That image can contain as much of the original data as you like and can be stored on

Connecting the world with E-Tech



"OEM/ODM WELCOME"



The E-Tech Advantages

- V.34 external and internal modems available
- A complete line of pocket and PCMCIA modems
- ISDN TA and NT1 products
- ISO 9001 Certified
- PTT approvals in over 30 countries

E•TECH

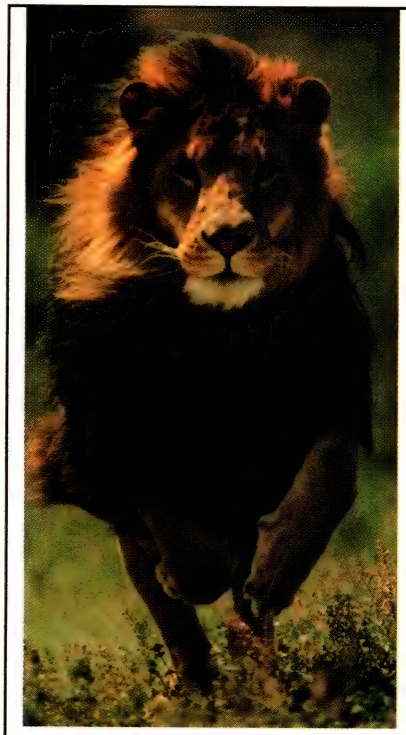
E-TECH, INC.
22, R&D Road 2, Science-Based Industrial Park,
Hsin-Chu,Taiwan, R.O.C.
TEL: 886-35-774991 • FAX 886-35-777751
BBS: 886-35-775395

BABT REN-1 BZT FC

System Show
Booth Number: "D 16 in Product Hall 16"

Circle 551 on Inquiry Card (RESELLERS: 552).

Circle 70 on Inquiry Card (RESELLERS: 71).



"With grueling competition... SuperTCP [Suite]* pulled ahead to garner Communication Week's MAX Award."

-Communications Week, April 24, 1995

"Frontier's SuperTCP [Suite] for Windows boasted the most applications of any product we tested, yet it was among the easiest packages to set up."

-Data Communications, Feb '95
Tester's Choice Award

"This product is the Swiss Army knife of the TCP/IP client: It has an implement for every application. [Including NFS, X Windows and Internet Access]"

-LAN Magazine, April '95
Product of the Year

Great reviews. Now judge for yourself.
Call today for your free eval CD
1-800-929-3054

Frontier Technologies Corporation

World Wide Web: www.frontiertech.com
Email: SuperTCP@frontiertech.com

1994 1994 1994 1994 1995 1994

©1995FrontierTechnologies,Inc. All right reserved *Formerly known as SuperTCP Pro

A Message to Our Subscribers

From time to time we make the BYTE subscriber list available to other companies whose products or services would be of interest to our readers. We take great care to screen these companies, choosing only those who are reputable. Furthermore, subscriber names are made available for direct mail purposes only; telemarketing calls are strictly prohibited.

Many BYTE subscribers appreciate this carefully managed program, and look forward to receiving information of interest to them via the mail. While we believe this information is of benefit to our subscribers, we firmly respect the wishes of any subscriber who does not want to receive promotional literature. Should you wish to restrict the use of your name, please send your request (including your magazine mailing label, name, address, and subscription account number) to:

BYTE Magazine
Subscriber Services
PO Box 555
Hightstown, NJ 08520

BYTE
The Magazine of Technology Integration

nearly any SCSI device, including tape. SnapBack itself can be run from a hard drive or a floppy disk on any machine that will boot DOS. Once SnapBack is running, it doesn't care what OS it's installing on the target disk, nor does that target disk have to be formatted.

Novell system administrators will love the newest version of SnapBack, which lets you back up a hard drive and transfer everything to a new and larger drive with a larger Novell partition.

If you need this, you need it bad.

Our next upgrade was to replace the Pentium chip in Pentafluge. Intel makes it very easy to replace your math-defective Pentium chip. It took me longer than it will take you, because I happen to know a senior Intel vice president, and I called him. My friend handed the job to another executive, who passed it along to a third;

Intel really wants that old math-defective Pentium chip back, and if you don't send it in, they'll charge you about $500.

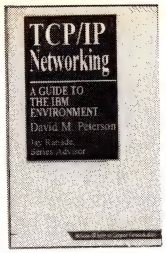
eventually I got connected to the people who do this routinely, which is where I should have started. They asked a number of intelligent questions to establish the speed of my current Pentium chip and the kind of socket it sits in. Then they got my address and a credit-card number.

The credit-card number is required so that you'll have an incentive to return your old chip: Intel really wants that chip back, and if you don't send it in, they'll charge you about $500. However, they send self-addressed prepaid packaging, so returning your old chip is both simple and free.

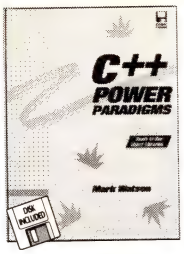
The new chip comes with complete instructions. It took me less than 5 minutes to power down Pentafluge, open him up, replace his Pentium chip with the new one, connect the chip fan to the power supply, button up the machine, and restart it. It took another 5 minutes to box up the old chip and get it out.

I hoped my next hardware upgrade would be as easy as upgrading the Pentium, but it

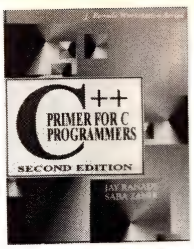
8820987-XX $29.95
Counts as 2/Hardcover



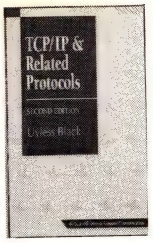
0496633 $50.00



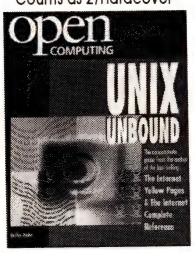
9117864 $45.00



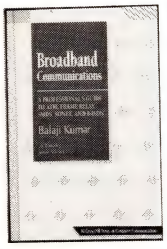
0514879 $34.95
Softcover



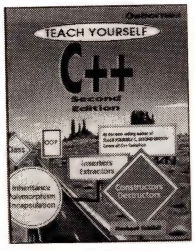
0055602 $50.00



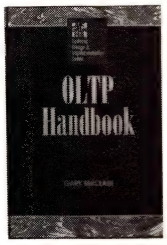
8820502 $27.95
Softcover



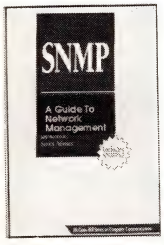
0359687-XX $60.00
Counts as 2



8820251 $24.95
Softcover

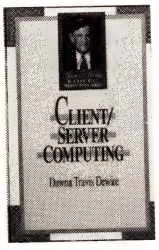


0449856 $49.50

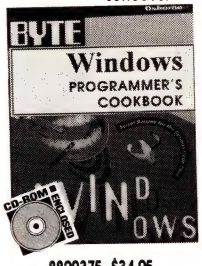


0203598-XX $65.00
Counts as 2

0062153-XX $40.00
Counts as 2

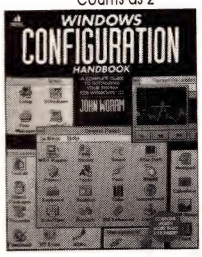


016732X $40.00

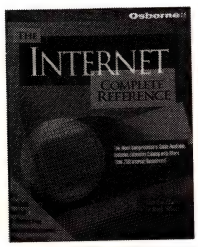


8820375 $34.95
Softcover

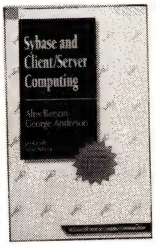
0050767 $50.00



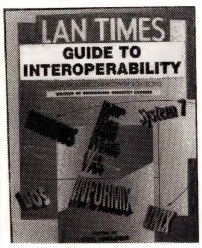
5866625-XX $34.00
Counts as 2/Softcover



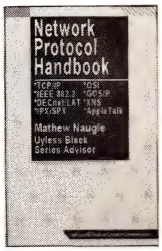
8819806 $29.95
Softcover



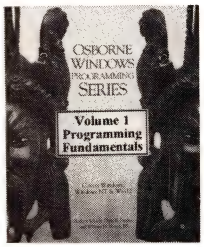
0052034 $50.00



882043X $29.95
Softcover

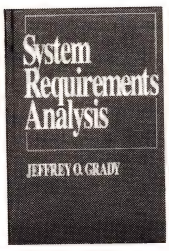


0464618 $49.50

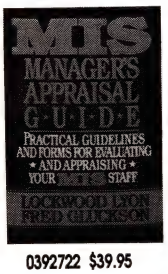


8819903 $34.95
Softcover

3279P $26.95
Softcover

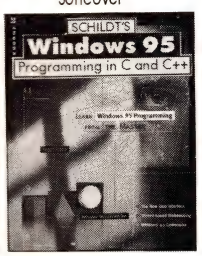


0239940 $55.00

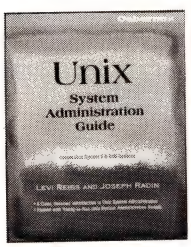


0392722 $39.95

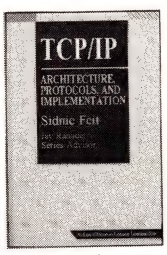
0574421 $54.50



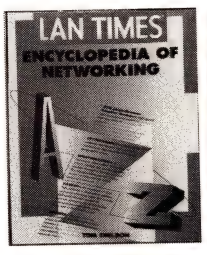
8820812 $29.95
Softcover



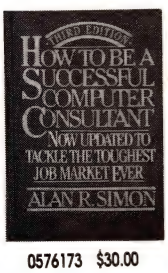
8819512-XX $34.95
Counts as 2/Softcover



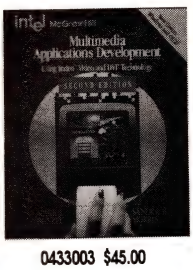
0203466 $45.00



8819652-XX $39.95
Counts as 2/Softcover



0576173 $30.00



0433003 $45.00

If card is missing, write to: **Computer Professionals' Book Society,**
A Division of The McGraw-Hill Companies, P.O. Box 549, Blacklick, OH 43004-9918

PHONE: 1-614-759-3666 (8:30 a.m. to 5:00 p.m. EST Monday-Friday)

FAX: 1-614-759-3749 (24 hours a day, 7 days a week)

THE EASY, RELIABLE WAY TO SATISFY YOUR PROFESSIONAL NEEDS

4 BOOKS FOR ONLY $4.95

when you join the
Computer Professionals' Book Society

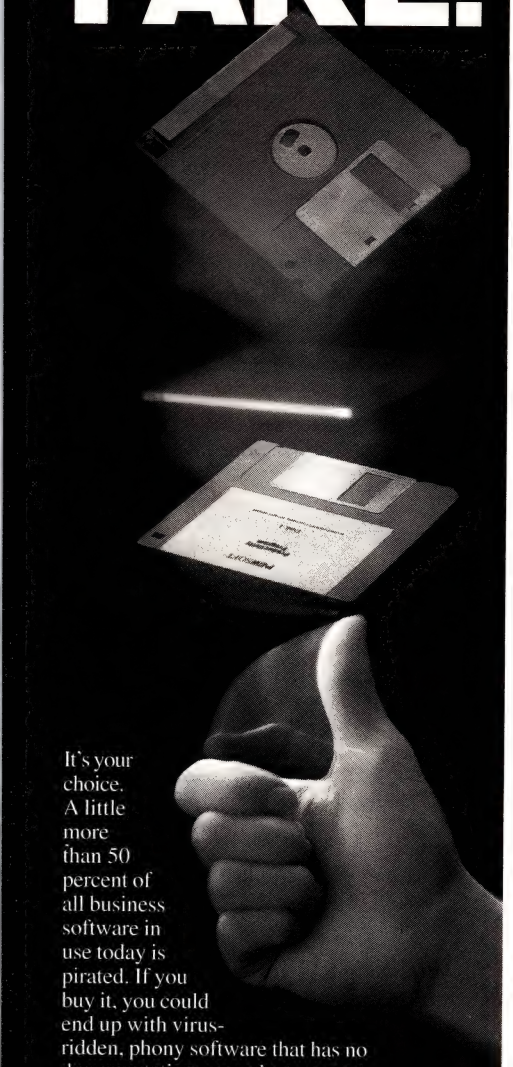
Values up to $209.50

As a member of the Computer Professionals' Book Society... you'll enjoy receiving Society bulletins every 3-4 weeks containing exciting offers on the latest books in the field at savings of up to 50% off the regular publishers' prices. If you want the Main Selection, do nothing and it will be shipped automatically. If you want another book, or no book at all, simply return the reply form to us by the date specified. You'll have at least 10 days to decide. If you ever receive a book you don't want due to late delivery of the bulletin, you can return it at our expense. And you'll be eligible for FREE BOOKS through the Bonus Book Program. Your only obligation is to purchase 3 more books during the next 2 years, after which you may cancel your membership at any time.

All books are hardcover unless otherwise noted. Publishers' prices shown. If you select a book that counts as 2 choices, write the book number in one box and XX in the next. A shipping/handling charge & sales tax will be added to all orders. © 1995 CPBS

BYP1095

HEADS, IT'S REAL. TAILS, IT'S FAKE.



It's your choice. A little more than 50 percent of all business software in use today is pirated. If you buy it, you could end up with virus-ridden, phony software that has no documentation or product support.

Selling or copying pirated software without authorization is against the law, with severe criminal and civil penalties including imprisonment of up to five years, fines of up to $250,000, or both. If you suspect the sale or use of pirated software, call the BSA Anti-Piracy hotline:

(800) 688-BSA1 (2721)

BSA Business Software Alliance

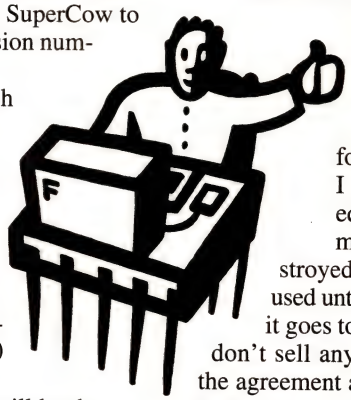
© 1993 Business Software Alliance. All rights reserved.

didn't work out that way.

It started with a Western Digital Caviar AC31000 1.1-GB hard drive, which I used to upgrade SuperCow, the Gateway 2000 486DX2/66. I was in a hurry, so I figured that rather than transferring all the files from the 500-MB hard drive SuperCow came with, I'd install the Caviar as a second physical drive. Western Digital's instructions are clear and complete.

Alas, when I tried to partition the new drive, SuperCow could see only about 25 MB of the 1.1 GB. The instructions warned that might happen; the remedy is to get a new BIOS. That costs $80, and you get it from Micro Firmware (Norman, OK, (405) 573-5501; http://www.firmware.com). Ordering the BIOS took less than 5 minutes, including rebooting SuperCow to get the current BIOS version number.

SuperCow uses flash ROM, so the new BIOS came on a floppy disk. The documentation is excellent. About 10 minutes later, I had installed the BIOS and used FDISK to partition the Caviar AC31000. Formatting took another 10 minutes or so.



For most of you, that will be the end of the story, but apparently nothing is simple at Chaos Manor. My hard drive worked just fine, Windows for Workgroups came up, and I could share the new drive across the network—but for reasons we still don't understand, the Future Domain 8-bit SCSI card that runs Network Archivist and its DAT drive simply would not work.

I have two versions of that SCSI card, an ancient one that has no ROM and is thus ideal for using a DAT since it takes up no memory unless the tape is actually operating, and a later version with ROM that will run an 8-bit SCSI device string, including the Maximum Storage Duette read/write optical drive. Both worked fine before I upgraded the BIOS; neither works now. On boot-up, they report "Internal Self Check Failure."

I reported this to Micro Firmware and shortly after got E-mail from Robert Braver, president of the company. He made several suggestions, all sensible. None worked. Finally he asked me to send him the SCSI cards, which I did. Of course, they worked perfectly when he tried them on some of his Gateway 2000 486DX2/66 systems.

The next step will be to swap motherboards. Micro Firmware has offered to send me one; they're far more curious about what has caused this than I am.

The bottom line here is that the Western Digital Caviar AC31000 is easy to install and works splendidly. If you need to install a new BIOS—and you probably will if you have a machine more than a few years old—that won't be difficult. If you have problems, Micro Firmware has excellent technical support.

About a month ago, I got a strange offer, which I presume was made to a lot of journalists: Fujitsu would be pleased to send me one of its DynaMO 230 magneto-optical (MO) drives if I'd sign a pledge not to sell it for a year. Clearly, they're trying to break the lock SyQuest and Iomega established in much the same way.

This was no problem for me. I never sell anything I get for review. Some equipment goes back to the manufacturer, some gets destroyed, and quite a lot just gets used until it's obsolete, after which it goes to a local school; but I sure don't sell any of it. Anyway, I signed the agreement and specified the external model.

It's neat. The external drive is 5 by 8 by 1.5 inches thick, considerably smaller than the DAT unit. It comes with a little stand that will hold its slot vertical, but I laid it on its back. Unfortunately, I wasn't paying attention. I put it on the tower case of the Cheetah 386 and put the DAT unit on top of it. Over a week later, I discovered that I'd laid it upside down, completely covering the ventilation holes. I don't recommend that as standard practice, but it doesn't seem to have done any harm.

The DynaMO 230 came with an Adaptec 16-bit EZ-SCSI card. Installation was simple. Adaptec's documents are complete, and their installation software took care of it all. I had the DynaMO 230 running in 10 minutes. Then, just for luck, I put Network Archivist and the DAT drive on the same SCSI string. This is the drive that normally runs off the Future Domain card I'd sent to Micro Firmware for testing. When I booted up, the Adaptec card announced that it had found both the optical and tape drives, and when I brought up Network Archivist, that ran fine. Both the DAT drive and the DynaMO 230 are now sharable network resources.

The DynaMO 230 came with an order form for more optical disks: a five-pack

of 230-MB MO disks costs $185. A 230-MB optical disk actually formats to 217 MB, so your medium cost is about 17 cents a megabyte. The optical disks are smaller (about the size of a 3½-inch floppy disk), and the drive is light and easy to carry around. The medium cost with DAT is about 1 cent a megabyte, but tape is a lot slower and less convenient.

The Fujitsu DynaMO 230 seems reliable. I've beat the living daylights out of it by setting up a batch file that writes and overwrites it for hours at a time. I did get a write-protect error when it was upside down, but standing it up to get some ventilation fixed the problem. It's fast. Though not as fast as the current generation of hard drives, it's faster than those we had five years ago. It takes a lot less time to write a backup copy to an optical drive than to a tape drive. Speed is important to backup systems: unless they're fast, you won't use them often. Every hour or so, I write a copy of my current work to a different machine; it would be as easy to write to an optical disk.

Everyone needs more disk space. If you are thinking of expanding, optical drives like Fujitsu's DynaMO 230 are well worth considering.

Continuing with upgrades, there's W95; I've had five builds in the last month. Each one cures another bug or two.

We went through builds 464, 480, 495, 501, and suddenly jumped to 950, which is probably a symbolic number. Build 950 installed easily—all the upgrades have—or so I thought until I tried to access the network.

There wasn't any network. Pentafluge couldn't see any other machines out there. I nearly panicked. Then I remembered I'd had a similar problem with OS/2 Warp Connect, so I tried the same remedy: I turned the machine off, counted to 10, and turned it back on.

That did it. When W95 came up, I looked into the Network Neighborhood folder, and voilà!, there were all my network resources.

There are still some problems. For example, while I use Microsoft Word for complex editing, I prefer to create text with a character-based editor. For years, I used the stand-alone version of Q&A Write, but my experience with Word has got me accustomed—*addicted* might be a better word—to using a mouse for moving and deleting blocks of text. Stand-alone Q&A Write doesn't have mouse support, but the Write built into Q&A 4.0 does, and I decided to write this column using that.

continued

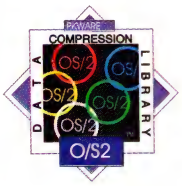
PKWARE®

Data Compression Library® Products

The PKWARE Data Compression Library products allow you to include state-of-the-art, patented data compression technology within your software applications. Data produced by the PKWARE Data Compression Library products is compatible across platforms!

The PKWARE Data Compression Library products offer an all-purpose data compression algorithm that compresses ASCII or binary data quickly. An adjustable dictionary size allows software to be fine-tuned for maximum speed or compression efficiency. The use of application-defined callback functions allow maximum flexibility. No runtime royalties. The format used by the compression routine is completely generic and not related to the PKZIP® file format.

Versions available for DOS, OS/2, Windows, Win32, DOS32, and UNIX (call for latest platform availability).



• Compatible with IBM Cset/2 & Borland C++ for OS/2.

for OS/2 $350

• Compatible with Microsoft Windows 3.x applications.

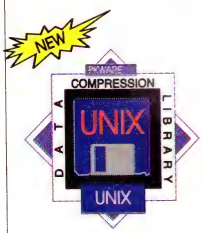
for Windows $350

• Separate versions for Intel, Alpha object, and Power PC.

for Win32 $375 ea.

• Compatible with popular 16-bit language compilers.

for DOS $275



• Separate versions for SCO, AIX, Solaris 1.x Sparc, Solaris 2.x Sparc, Solaris 2.x X86, and UnixWare.

for Unix $450 ea.

• Compatible with most 32-bit DOS extenders.

for DOS32 $350

PKWARE® INC.
The Data Compression Experts®

9025 N. Deerwood Drive
Brown Deer, WI 53223-2437
Phone: (414)354-8699 Fax: (414)354-8559
WEB: http://www.pkware.com

Please add $5.00 Shipping & Handling per package in the U.S. & Canada; $11.25 overseas. Wisconsin residents please add applicable state & county sales tax. No COD.

VISA CHECK Money Order

Copyright 1995, PKWARE, Inc. PKWARE, the PKWARE logo, PKZIP, and the PKWARE Data Compression Library are registered trademarks of PKWARE, Inc. Trademarks of other companies mentioned here appear for identification purposes only and are the property of their respective companies.

BY1095

Circle 90 on Inquiry Card.

Anyway, all went well until I needed to transfer an address from a previous column. What I usually do is open a DOS window running Microlytics' GOfer, send it out to search my old columns until it finds the company name, and use the Windows editing facility to mark and copy the text from the GOfer window and then paste it into the Q&A Write window. This works fine with stand-alone Q&A Write; but when I tried it with Write inside Q&A itself, I got an error message inviting me to recover with "escape." That "recovered" in the sense that I was back at the command level of Q&A, but all my text was gone.

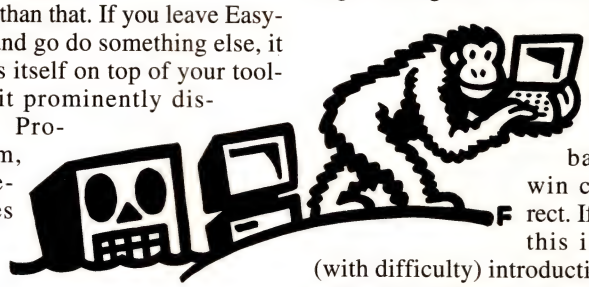
Fortunately, I save early and often, particularly before doing anything odd; I don't leave an editing window without saving my text first. Still, it's annoying, because text transfer through copy and paste is a convenient Windows feature. By mucking around, I find that I can paste into stand-alone Q&A Write, save the file, and read that saved file into Q&A. That's not a very convenient kludge.

I suppose I'll just have to bite the bullet and start using Word for text creation. On the other hand, finding bugs is fun....

W95 has multimedia support and a ton of features, so it's a natural for a multimedia tutorial program on CD-ROM. Alas, EasyTutor from CRT Multimedia isn't the right one for me. It has some slick multimedia, but while the introductory level is surely that, the detailed level doesn't go anywhere near far enough.

For instance, at the Microsoft W95 dog and pony show, they showed a lot of tricks using the registry and registry editor. W95 help on using the registry is skimpy to nonexistent, so I'd hoped this tutorial would tell me more. Alas, the Power User topic is no more useful on the subject than Microsoft's Help file.

It's worse than that. If you leave EasyTutor open and go do something else, it not only puts itself on top of your toolbar, where it prominently displaces the Programs item, but it somehow bollixes up the Alt-Tab task-switching feature. Closing EasyTutor fixes both problems.



I sure wish I had a good tutorial to explain the W95 registry, though.

I continue to work on Roberta's reading-instruction program. The Mac version has produced some astonishing results in beta tests. I'm upgrading the QuickBasic DOS version preparatory to putting it on Windows with Visual Basic.

In both cases, I'm using Crescent Tools from Progress Software. Visual Basic plus Crescent Tools gives you some truly awesome programming capabilities. The programs may not be as fast and compact as programs written in C++, but I really don't care. With Visual Basic, I can get things running in days, not months.

I'm also looking at 3D Choreographer from AniCom. It produces stand-alone animated sequences you can call with programs like PowerPoint—and, of course, Visual Basic. I've only just started with it, but it seems easy to use and solid.

The book of the month is *Independent Birth Of Organisms* by Periannan Senapathy (Genome International, 1994). Fair warning: this book is heavy reading, being nothing less than a new theory of evolution; or, rather, a critique of why current theories based on Darwin can't be correct. If nothing else, this is a readable (with difficulty) introduction to modern molecular biology. I found it fascinating, but then I like complicated scientific detective stories.

There are two computer books of the month from The Waite Group: *Visual Basic 4 How-to for Windows* and *QB Primer Plus*. These are excellent as both introductions and reference works.

There are about a zillion Internet books. One that's sort of fun is by Rawn Shah and James Romine, *Playing MUDs on the Internet* (Wiley, 1995). A MUD is a Multiuser Dungeon, and this will tell you what they are, how they work, and which ones to look into. That's worth knowing, because I suspect MUD technology will become important for business and education in the future.

The game of the month is Terror from the Deep, MicroProse Software's follow-on to XCOM: UFO Defense. The aliens are back, and they're really angry. Warning: as with many MicroProse games, this was released with bugs. Log on to GEnie or another on-line service and download the upgrade patch. Also available on GEnie is a great little "cryogenics" program that will let you transfer your XCOM troopers into this game.

One final note: they fly the DC/X with a mouse. When the Air Force turned the DC/X over to NASA after the flight, the presentation plaque sported a model of the ship and a Macintosh mouse. ■

Jerry Pournelle holds a doctorate in psychology and is a science fiction writer who also earns a comfortable living writing about computers present and future. Jerry welcomes readers' comments and opinions. Send a self-addressed, stamped envelope to Jerry Pournelle, c/o BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. Please put your address on the letter as well as on the envelope. Due to the high volume of letters, Jerry cannot guarantee a personal reply. You can also contact him on the Internet or BIX at jerryp@bix.com.

Product Information

The Caviar AC31000 (1 GB, $349) is easy to install and works splendidly. Contact Western Digital, Irvine, CA, (800) 832-4778 or (714) 932-5000; http://www.wdc.com.
Circle 1240 on Inquiry Card.

If you're thinking of expanding, optical drives like the **DynaMO 230 (external, $749; internal, $649)** are well worth considering. Contact Fujitsu Computer Products of America, San Jose, CA, (800) 626-4686 or (408) 432-6333.
Circle 1241.

Installing and using **PartitionMagic (for OS/2 and DOS, $69; for DOS and Windows, $49)** is easy. Contact PowerQuest Corp., Orem, UT, (800) 379-2566 or (801) 226-8977; http://www.powerquest.com.
Circle 1242.

Novell system administrators will love **SnapBack 3.06 (per server, $995),** which lets you back up a hard drive and transfer everything to a new and larger drive with a larger Novell partition. Contact Columbia Data Products, Altamonte Springs, FL, (407) 869-6700; http://www.cdpi.com.
Circle 1243.

System Commander ($99.95) lets you change OSes more easily than you used to be able to change CONFIG.SYS and AUTOEXEC.BAT. Contact V Communications, Inc., San Jose, CA, (800) 648-8266 or (408) 296-4224.
Circle 1244.

The game of the month is **Terror from the Deep (about $49.95).** Contact MicroProse Software, Hunt Valley, MD, (800) 879-7529 or (410) 771-1151; http://www.microprose.com.
Circle 1245.

3D Choreographer ($149) seems easy to use and solid. Contact AniCom, Inc., Chapel Hill, NC, (800) 949-4559 or (919) 967-2890; http://www.spadion.com/anicom.
Circle 1246.

THE TENTH ANNUAL PC EXPO IN CHICAGO

EXPOSITION & CONFERENCE
IT'S THE CELEBRATION
THAT'S STRICTLY BUSINESS
OCTOBER 3–5,1995
McCORMICK PLACE EAST, CHICAGO, IL

C EXPO IN CHICAGO IS NOW ON-LINE! HTTP://WWW.SHOWNET.COM

CELEBRATE A DECADE OF EXCELLENCE

It's been an exciting ten years since PC EXPO made its debut in Chicago. Today, PC EXPO in Chicago is the significant corporate computing event in the nation's second largest computer market. It's the only opportunity in the Midwest for corporate and volume buyers to find solutions for every business computing need, and vendors to meet qualified buyers from major corporations.

In addition, PC EXPO in Chicago will feature a comprehensive, cutting-edge Corporate Education and Training Program, including 43 sessions, 3 workshops and 10 full-day tutorials, designed to meet the needs of everyone from the computing novice to the seasoned professional.

Join the celebration. PC EXPO in Chicago. The forum for corporate computing in the Midwest.

BLENHEIM®

PC EXPO in Chicago is produced and managed by Blenheim Group USA, Inc.
One Executive Drive, Fort Lee, NJ 07024
PC EXPO® is a registered service mark of Blenheim Group USA, Inc.

PC EXPO in Chicago is a professional trade event only. Minors under the age of 18 may not register and are not permitted on site. PC EXPO reserves the right to use photographs taken of you at the show for promotional purposes. Your badge is nontransferable and will be confiscated and terminated immediately upon any attempt to transfer or sell it.

FOR INFORMATION ON THE LARGEST COMPUTING EVENT IN THE MIDWEST, CALL 801-655-8024.

9684

WHAT'S NEW Hardware

PREVIEW MAC POWERBOOKS

Portable Mac: Power, Long Battery Life

With a 100- or 117-MHz PowerPC 603e at its heart, Apple Computer's latest line of PowerBooks combines RISC-processing power with insanely great battery life. Apple went with the 117-MHz specification for two reasons: 603e yields at 120 MHz were problematic, and Apple doesn't want to repeat the supply shortages that plagued the PowerBook 500 series.

BYTE looked at a preliminary PowerBook 5300c with a 100-MHz 603e and a 10.4-inch active-matrix color LCD screen. The PowerBook 5300c's long battery life is achieved through the power-saving features of the 603e, which saves its internal state while turned off, and the power management software in the Mac OS, which literally switches off the processor between keystrokes. A single lithium-ion battery provides an estimated 3 to 5 hours of battery life.

Battery-Life Performance

System	Hours
PowerBook 5300c (100-MHz PowerPC 603e)	6.87
PowerBook 540c (33-MHz 68LC040, two Type II NiMH batteries)	6.00
Toshiba 2150CDT (75-MHz 486DX4)	5.20
Toshiba T4900 CT (75-MHz Pentium)	4.25

We used BYTE's Thumper 2 on the PowerBook 5300c and obtained an impressive battery life of nearly 7 hours (see the table above). Although Thumper 2 imitates some keyboard activity, the 603e processor switches off between keystrokes, so BYTE's battery-life benchmark number is optimistic. But it does indicate that Apple's 3- to 5-hour estimate for heavy usage appears accurate. Your mileage will vary, depending on your work patterns and the PC Card (formerly PCMCIA) peripherals you use.

PowerBook 5300c
With a 100-MHz processor, 8 MB of RAM (expandable to 64 MB), a 500-MB hard drive, and a 9½-inch dual-scan gray-scale LCD screen, $2200; with a 10.4-inch active-matrix color LCD screen, $3800.

Apple Computer
Cupertino, CA
(800) 776-2333
(408) 996-1010
Circle 976 on Inquiry Card.

Other notable features include a 32-bit I/O bus; a PC Card slot, which holds one Type III or two Type II cards; an infrared communications port; and a storage bay that holds a removable floppy drive or other storage media.

In sum, the PowerBook 5300c racks up Pentium-caliber performance and impressive battery life far beyond what we've seen with 486- or Pentium-equipped notebooks, all in a package weighing in at 6.2 pounds.

—**Tom Thompson**

133-MHZ SUPERSYSTEM

Specifically designed for CAD and engineering applications, the Tri-CAD 133/SS is built around Intel's 133-MHz Pentium processor and a PCI-bus motherboard. The 133/SS ($7399) comes with 32 MB of EDO RAM; a 1.6-GB hard drive; 256 KB of TriStar's proprietary CADcache; a dual-channel 32-bit EIDE controller; an Elsa Winner 2000 Pro/X graphics accelerator with 8 MB of video memory, 1600- by 1200-pixel resolution, and an 85-Hz refresh rate; a 21-inch ViewSonic digital monitor; a hex-speed CD-ROM drive; and a 28.8-Kbps internal fax modem.

Contact: Tri-Star Computer, Tempe, AZ, (800) 800-7668 or (602) 731-4926.
Circle 980 on Inquiry Card.

REMOVABLE HARD DISK SYSTEMS

Available in capacities of 1, 1.7, 2.1, 4.2, and 9 GB, the Stampede line of storage systems offer access times as fast as 8 ms and data transfer rates as fast as 20 MBps and allow you to combine 3½- and 5¼-inch drives within a single docking station. Each drive module can accommodate a fast SCSI-2 or fast-and-wide SCSI-2 hard drive. Each SCSI address can accommodate more than 63 GB of data, and you can daisy-chain Stampede docking stations to achieve more than 400 GB of storage capacity per SCSI bus. Stampede systems ($1750 each) are available in two-, four-, and eight-bay desktop docking stations, in an eight-bay desk-side pedestal, and in an eight-bay rack-mount configuration.

Contact: MountainGate Data Systems, Reno, NV, (800) 556-0222 or (702) 851-9393; sales@mntgte.lockheed.com.
Circle 982 on Inquiry Card.

CENTRAL-SITE CONCENTRATOR

XpressStack, a series of three modular, stackable central-site concentrators (from US$9450), employ multi–RISC processor technology for the best possible throughput, whether you use one or multiple modules. For basic-rate ISDN connections, XpressStack BRI provides 16 64-Kbps channels, support for a single 10Base-T LAN interface, and an asynchronous console port. XpressStack PRI provides the same concentration via one ISDN PRI interface, which provides 23 North American (or 30 European) 64-Kbps channels. A 24-port intelligent Ethernet switch, XpressStack VLS creates an independent 10-Mbps Ethernet segment.

Contact: Gandalf Technologies, Nepean, Ontario, Canada, (800) 426-3253 or (613) 723-6500; http://www.gandalf.ca.
Circle 986 on Inquiry Card.

MULTIFUNCTION WORKCENTER ▲

The Document WorkCenter Pro 610 ($2495) delivers plain-paper laser-faxing and digital-copying features together with optional printing and scanning. You can program up to 100 auto-dial numbers and up to 10 one-touch group dials for fax broadcasting. Up to 10 individual mailboxes let you receive and retrieve faxes from remote locations. The 40-page memory is upgradable to 200 pages ($199), and the 250-sheet paper tray is upgradable to 500 sheets ($99). The optional Windows and DOS printing capability ($495) supports PCL 5e with 600-dpi resolution. The scanning option ($99) offers a resolution of 300 by 300 dpi, which you can use with TWAIN-compatible software packages, and OCR capability via TextBridge 3.0.

Contact: Xerox, Palo Alto, CA, (800) 275-9376 or (415) 813-6800; http://www.xerox.com.
Circle 985 on Inquiry Card.

VIRTUAL-REALITY HEADGEAR ▲

An integrated headset, the VFX1 Headgear Virtual Reality System ($995) features high-contrast 789- by 230-pixel LCDs, a three-axis VOS Head Tracker, high-fidelity stereo headphones, a ComSet microphone, a Smart Visor, and custom lenses. The system includes the CyberPuck controller, a device that provides additional virtual-reality input, and a CD-ROM with playable versions of PC-based games such as Electronic Arts' Magic Carpet and Interplay's Descent. The VFX1 Headgear Virtual Reality System also incorporates Access.bus technology, which lets you simultaneously connect up to 125 devices to your PC.

Contact: Forte Technologies, Rochester, NY, (716) 427-8595; sales@fortech.com.

Circle 981 on Inquiry Card.

INTERNAL OR EXTERNAL TAPE BACKUP DRIVES

The Ditto 420 (internal, $99.95; external, $199.95) can back up 420 MB of information on a single QIC-wide tape. Using Travan technology, which enables you to back up and restore more than 3 GB of information in a single, unattended session, the Ditto 800 (internal, $199.95; external, $299.95) has the ability to back up 800 MB of data, and the Ditto 3200 (internal, $299.95; external, $399.95), 3.2 GB of data. The Ditto 800 and Ditto 3200 drives are all compatible with QIC, QIC-wide, Travan, and Irwin tape formats.

Contact: Iomega, Roy, UT, (800) 697-8833 or (801) 778-1000; http://www.iomega.com.

Circle 979 on Inquiry Card.

MULTIMEDIA X TERMINALS

The TekXpress XP400 series X terminals ($2695 to $4795) are designed to provide a single desktop solution for graphical access to network information and distributed multimedia applications. The systems all come with an LSI 33120 RISC processor; 8 MB of RAM, expandable to 136 MB; 2 MB of video memory; a twisted-pair Ethernet interface; two RS-232 ports; and a monitor. Options include an MPEG digital-video coprocessor, an audio coprocessor, thinnet and thicknet interfaces, flash memory, a dual-slot PC Card (formerly PCMCIA) interface, a parallel port, a keyboard, and a Sony 20-inch monitor. With the Tek XpressWare software, the XP400 series systems can access network-mainframe, legacy, and Unix applications. With the WinDD software, you can display Windows and other PC applications on your XP400.

Contact: Tektronix, Wilsonville, OR, (800) 547-8949 or (503) 682-7300; http://www.tek.com.

Circle 983 on Inquiry Card.

COLOR-THERMAL PRINTERS

The latest models in the Spectra*Star line of plain-paper color-thermal printers are the Model 240 ($2995) and the top-of-the-line Model 280 ($3995). Both models support PostScript Level 2 and Pantone-certified color matching and offer serial, parallel, and AppleTalk ports. A Color Copy Cartridge (about $200) plugs into the Pockette slot and provides a connection to popular color scanners, so you can also use the printers as full-color copiers.

The Spectra*Star Model 240 uses a 25-MHz Intel 80960CA

RISC processor and comes with 6 MB of RAM (expandable to 24 MB) and 52 professional fonts. It can print at resolutions of up to 600 by 300 dpi with additional RAM. The Spectra*Star Model 280 uses the Intel 33-MHz 80960CF RISC processor and comes with 10 MB of RAM (which is expandable to 32 MB), 52 professional fonts, and two Pockette slots, which can accommodate a plug-in Ethernet LAN cartridge and a 120-MB hard drive cartridge.

Contact: General Parametrics, Berkeley, CA, (800) 223-0999 or (510) 524-3950.

Circle 992 on Inquiry Card.

CABLE MANAGEMENT TOOL

The PentaScanner+ with 2-Way Injector+ ($4595), PentaScanner Cable Admin with Super Injector ($2795), and PentaScanner+ with Super Injector ($3495) all offer hand-held cable certification and diagnostics; 100-MHz operation; support for UPT, STP, ScTP, and coaxial cable; measurement of NEXT, attenuation, length, impedance, resistance, capacitance, attenuation to cross-talk ratio, wire map, and noise; support for network topologies, such as 10- and 100-Mbps Ethernet, Token Ring, and ATM; replaceable, rechargeable nicad batteries; printing of test results; a backlit display; and flash memory. The 2-Way Injector+ accessory measures near-end cross talk and attenuation on both ends of the installed network cable link.

Contact: Microtest, Phoenix, AZ, (602) 952-6400; 70414,2116@compuserve.com.

Circle 991 on Inquiry Card.

DO-IT-YOURSELF CD-ROM RECORDING

At the heart of the Spressa 920 is an internal CD-R drive with a maximum sustained data transfer rate of 300 KBps, a 1-MB data buffer, and the ability to record a 650-MB disc in about 30 minutes. If a buffer underrun occurs, the drive's disk-recovery algorithm seals off the section of the disc where the error occurred, allowing the Spressa 920 ($1999.95) to use the rest of the disc. The drive can record in many CD formats, including CD-ROM, CD-ROM XA, CD-Audio, Audio-Combined CD-ROM, CD-I, Photo CD, and Video CD, and offers three recording methods: disc at once, incremental, and multisession.

Contact: Sony Component and Computer Products Group, San Jose, CA, (800) 352-7669 or (408) 432-1600.

Circle 977 on Inquiry Card.

WHAT'S NEW Hardware

SCALABLE NETWORK SERVERS

The NetServer LS Series of network servers (about $6506 to $18,611) are scalable from single-processor Intel Pentium/75 systems to quad-symmetric-multiprocessor Pentium/100 and Pentium/133 systems. Features include a 64-bit clock-independent system bus; dual PCI peer buses; dual PCI fast-and-wide SCSI-2 controllers in RAID levels 0, 1, 5, and 6; dedicated Level 2 caches; error-checking-and-correcting memory that's expandable to 768 MB; and MPS support. A hot-swap disk subsystem lets you replace failed drives while the server continues to work and automatically reconstructs data on a spare drive. An Automatic Server Restart feature reactivates the server if the network OS hangs.

Contact: Hewlett-Packard, Santa Clara, CA, (800) 322-4772 or call local HP dealer; http://www.hp.com/go/netserver.

Circle 978 on Inquiry Card.

PCI-BASED MULTIMEDIA ACCELERATOR FOR POWER MAC

The Diamond Javelin Video 3000 series includes the Javelin Video 3240XL ($399), which provides 2 MB of video memory (upgradable to 4 MB) and supports 16.7 million colors at resolutions of up to 1152 by 870 pixels, and the Javelin Video 3400XL ($569), which contains 4 MB of video memory. Both models feature a 220-MHz DAC, which provides flicker-free refresh rates of up to 120 Hz, and the S3 Vision968, which provides digital-video scaling of up to 1280 by 1024 pixels.

Contact: Diamond Multimedia Systems, San Jose, CA, (800) 468-5846 or (408) 325-7000; http://www.diamondmm.com.

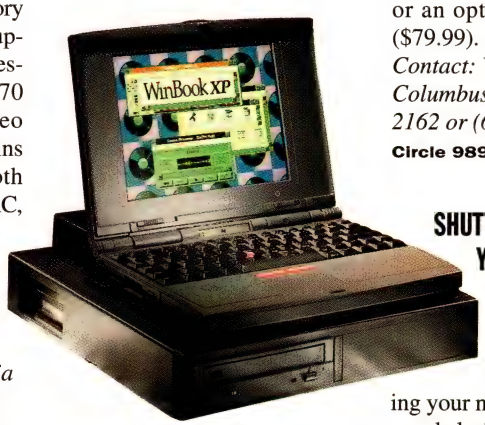
Circle 988 on Inquiry Card.

FAST ETHERNET ADAPTER

The Rockwell 2300-TX provides 10- or 100-Mbps automatic negotiation and connectivity to PCI-based desktop PCs and servers, as well as half- and full-duplex operation. You can port the VDA common-core software architecture across a range of network interface cards, OSes, and network-protocol environments. The Rockwell 2300-TX ($295) is fully compliant with the emerging IEEE 802.3u 100Base-TX Ethernet standard.

Contact: Rockwell Network Systems, Santa Barbara, CA, (800) 262-8023 or (805) 968-4262; http://www.rns.rockwell.com.

Circle 990 on Inquiry Card.



QUAD-SPEED CD-ROM DOCKING STATION AND MORE▲

WinBook Computer's docking station ($399) comes with a quad-speed CD-ROM drive, two ISA slots, dual 5¼-inch bays, automatic detection for external pointing devices, VGA, stereo output, and volume control.

In addition, the 100-MHz 486DX4 model of the WinBook XP notebook computer comes in two configurations: with a 10.3-inch dual-scan color screen, 4 MB of RAM (expandable to 32 MB), and a 340-MB removable hard drive ($1999); or with an 810-MB removable hard drive, an active-matrix screen, 16 MB of RAM, and a 14.4-Kbps internal fax modem ($4199). You also get your choice of pointing device—the standard Lexmark pointing stick, an optional Logitech 19-mm trackball ($29.95), or an optional Alps touchpad ($79.99).

Contact: WinBook Computer, Columbus, OH, (800) 468-2162 or (614) 481-8041.

Circle 989 on Inquiry Card.

SHUTTLE BIG FILES AMONG YOUR MACS

If you need to transport large data, graphics, or digital-video files without burdening your network, the DataDock may help. Two configurations are available: a $799 desktop unit, which accommodates two modules, and a rack-mount unit (from $885), which accommodates up to six modules. The hard drive modules ($870 to $2499) are available in fast SCSI-2 configurations with capacities of up to 4 GB each. Options include fast-and-wide SCSI-2 hard drives in the same capacities (from $3420); DAT drives of up to 8 GB ($1695 each); 270-MB Syquest modules ($790 each); and 230-MB magneto-optical drives ($1050 each).

Contact: MicroNet Technology, Irvine, CA, (714) 453-6100; micronet@aol.com.

Circle 984 on Inquiry Card.

DESKTOP-RECORDABLE CD-ROM SOLUTION

With CD-Write Now, you can record your own CD-ROM discs, storing 650 MB of data on each disc. Multisession support lets you write to the disc incrementally, performing up to 99 writing sessions on each CD-ROM. An optional recording-simulation mode enables you to test applications by simulating CD performance without actually writing to a disc. The basic package ($2495) includes a double-speed drive (a quad-speed drive is also available), authoring software for Windows or the Macintosh, and two discs.

Contact: Ten X Technology, Austin, TX, (800) 922-9050 or (512) 918-9182; tenx@zilker.net.

Circle 987 on Inquiry Card.

STORAGE SERVERS FOR NOVELL LANS ▼

The GlobalNet family of storage servers give up to 1024 users access to SCSI mass-storage devices over an Ethernet network. Each unit has built-in software and configures itself, registering on NetWare's server list as another attachable Novell server. The servers, which provide data transfer rates of up to 450 KBps, include GlobalNet SST ($7995), designed for large-capacity optical jukeboxes, GlobalNet Shuttle ($5995), for midrange optical jukeboxes, and GlobalNet Route 101 ($3995), for large hard drives and RAID drives.

Contact: Optisys, Glendale, AZ, (800) 327-1271 or (602) 997-9699; rzwick@optisys.com.

Circle 993 on Inquiry Card.

THE 1995 MICROGRAFX CHILI FOR CHILDREN COOK-OFF

TUESDAY NOVEMBER 14, 1995 6PM-11PM THOMAS & MACK CENTER (UNLV)

NATIONAL CENTER FOR MISSING & EXPLOITED CHILDREN

MICROGRAFX
Proud patron of the
Chili for Children Cook-Off

Join the computer industry's leaders for the hottest charity event of the year - the Micrografx Chili for Children Cook-Off. With lots of great eats, dillo-racin' fun and live music from the one and only Temptations, the party is sure to cook! Best of all, your $50 cook-off ticket will help support the National Center for Missing and Exploited Children. So come have a blast and help a great cause! For information or tickets, call The Chili Hot Line at 1-800-357-7255. Or stop by the Micrografx Chili for Children Booth in the lobby of the L.V.C.C. or the Sands Expo at Comdex/Fall. On behalf of the children, thank you in advance for your support.

MICROGRAFX CHILI FOR CHILDREN

A RECIPE FOR HOPE

1995 CATTLE BARON SPONSORS

Advanced Micro Devices
COMPUTER ASSOCIATES Software superior by design.
EPSON
IBM
Inc. MAGAZINE
intel
Kingston TECHNOLOGY CORPORATION
Lotus. Working Together
MICROGRAFX
Microsoft
mips/SiliconGraphics Computer Systems
PICTURETEL
SOFTBANK COMDEX
TEXAS INSTRUMENTS
ZD Ziff-Davis Publishing

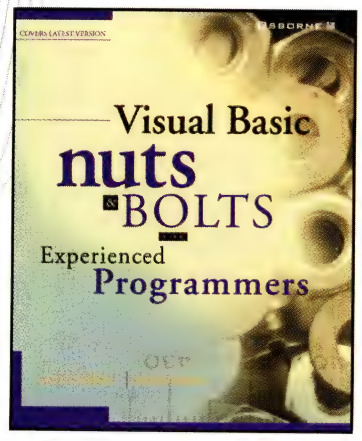
WHEN IT COMES TO CD-ROM. WE WROTE THE BOOK

BYTE Guide to CD-ROM, Second Edition
by Michael Nadeau
Includes One CD-ROM Disc
$39.95 USA
ISBN: 0-07-882104-5

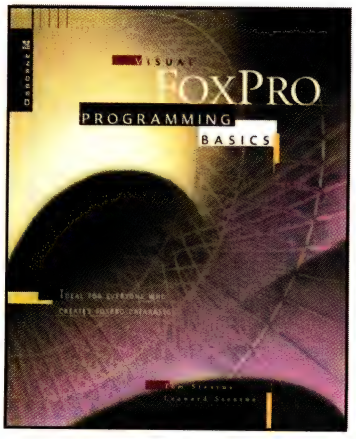
Now Fully Revised & Expanded!

This Exclusive
Book/CD-ROM Package Includes
• CD-ROM Buyer's Guide with Over 400 Reviews of CD-ROM Titles
• Demos & Samples of CD-ROM Applications

Part buyer's guide, part standards guide, and part trouble-shooter, the ***BYTE Guide to CD-ROM, Second Edition*** discusses all aspects of this burgeoning technology so you can take full advantage.



Visual Basic Nuts & Bolts: For Experienced Programmers
by Gary Cornell and Troy Strain
$24.95 USA
ISBN: 0-07-882141-X



Visual FoxPro Programming Basics
by Tom Stearns and Leonard Stearns
$24.95 USA
ISBN: 0-07-882092-8

The Programmer's Job Handbook: The Skills You Need to Stay Ahead in the '90s
by Eugene Wang
$24.95 USA
ISBN: 0-07-882137-1

OSBORNE McGraw-Hill

Available now at your local book and computer stores or call 1-800-822-8158.
Use your American Express, VISA, Discover, or MasterCard.

KEY=SF65BYL

AT NATIONWIDE STORES

BARNES & NOBLE
BEST BUY
BOOKSTAR
BORDERS
COMP USA
ELEK-TEK
MEDIA PLAY
MICRO CENTER
SOFTWARE, ETC.
SUPER CROWN
TAYLORS
WALDENBOOKS

BYTE/OSBORNE BOOKS ARE AVAILABLE AT THE FOLLOWING LOCATIONS

ALABAMA
Madison
Madison Books & Computers
PH: 205-772-9250
FAX: 205-461-8076

ARIZONA
Phoenix
Computer Library
PH: 602-547-0331

CALIFORNIA
Berkeley
Cody's Books Inc.
PH: 800-479-7744 in CA
PH: 800-995-1180 Nationally

Citrus Heights
Tower Books
PH: 916-961-7202

Cupertino
Computer Literacy Bookshops
PH: 408-973-9955

Davis
UCD Bookstore
University of California Davis
PH: 916-752-2944

Los Angeles
ASUCLA Students Store
PH: 310-206-0763

Mountain View
Printer's Inc.
PH: 415-961-8500

Palo Alto
Printer's Inc.
PH: 415-327-6500

Stanford Bookstore
PH: 800-673-2348

Sacramento
Tower Books
1600 Broadway
PH: 916-444-6688

San Francisco
Stacey's Professional Bookstore
PH: 800-926-6511
EMAIL: staceysbk@aol.com

San Luis Obispo
Earthling Bookshop
PH: 805-543-7951
FAX: 805-543-8488

Santa Barbara
Chaucer's Bookstore
PH: 805-563-0010

UCSB Bookstore
The University of California Santa Barbara
PH: 805-893-2082

Sunnyvale
Computer Literacy Bookshops
PH: 408-730-9955

COLORADO
Boulder
University Book Center
CU Boulder
PH: 303-492-6411
FAX: 303-492-0421

Colorado Springs
The Chinook Bookshop
PH: 719-635-1195
FAX: 719-635-0792

Denver
Biblio Tek
PH: 303-534-3460

Longmont
United Techbook Co.
PH: 303-651-3184
FAX: 303-651-3405

CONNECTICUT
New Haven
Yale Co-Op
PH: 800-ELI-YALE
FAX: 203-772-3665

FLORIDA
Gainesville
Construction Bookstore
PH: 904-378-9784
FAX: 904-378-2791

GEORGIA
Atlanta
Oxford Bookstore
PH: 404-262-3333
FAX: 404-364-2729

HAWAII
Honolulu
University of Hawaii Bookstores
PH: 808-956-4338
FAX: 808-956-4323

ILLINOIS
Naperville
Books and Bytes
PH: 708-416-0102
FAX: 708-416-0375

MARYLAND
College Park
Maryland Book Exchange
PH: 301-927-2510
FAX: 301-209-7118

Boston
Charlesbank Bookshops
PH: 617-236-7442
FAX: 617-236-7418

Burlington
SoftPro Books
PH: 617-273-2919
FAX: 617-273-2499
EMAIL: books@softproeast.com

Cambridge
Quantum Books
PH: 617-494-5042
FAX: 617-577-7282
EMAIL: quanbook@world.std.com

Newton Highlands
New England Mobile Bookfair
PH: 617-527-5817
FAX: 617-527-0113

MICHIGAN
Kalamazoo
Western Michigan University Bookstore
Western Michigan University
PH: 616-387-3930
FAX: 616-387-3941

MINNESOTA
Minneapolis
University of MN East Bank Bookstore
PH: 612-625-3005
FAX: 612-625-1861

NEW HAMPSHIRE
Hanover
Dartmouth Bookstore
PH: 800-624-8800 (outside NH)
PH: 800-675-3616 (in NH)
FAX: 603-643-5170

NEW JERSEY
New Brunswick
Rutgers University Bookstore
PH: 908-246-8448

NEW MEXICO
Albuquerque
Page One, Inc.
PH: 505-294-2026

NEW YORK
Buffalo
Village Green Bookstore
PH: 716-884-1200
FAX: 716-884-3007

Huntington
Books Revue
PH: 516-271-1442
FAX: 516-271-5890

New York City
Benjamin Books
PH: 212-432-1103
FAX: 212-432-1104

Coliseum Bookstore
PH: 212-757-8103
FAX: 212-489-0925

J & R Computer World
PH: 212-732-8600

McGraw-Hill Bookstore
PH: 212-512-4100
FAX: 212-512-4105

New York University Computer Store
PH: 212-998-4591

Rochester
Campus Connections (RIT)
PH: 716-475-2504

Village Green Bookstore
1954 West Ridge Road
PH: 716-723-1600
FAX: 716-723-1669

Village Green Bookstore
716 Monroe Avenue
PH: 716-461-5380
FAX: 716-461-9333

Syracuse
Syracuse University Bookstore
PH: 315-443-1654

OHIO
Cleveland
Business Outreach
PH: 216-348-1744
FAX: 216-348-0375

Dayton
Wilkie's Downtown
PH: 513-223-2541
FAX: 513-223-2869

Fairborn
Wilkie's Fairborn
PH: 513-429-1677

Lima
Readmore
217 Flanders
PH: 419-225-5826
FAX: 419-225-5537

Readmore's Hallmark
3330 W. Elm Street
PH: 419-225-5826

Youngstown
Youngstown State University Bookstore
PH: 216-742-3589
FAX: 216-742-3145

OREGON
Beaverton
Powell's Bookstore at Cascade Plaza
PH: 503-643-3131
FAX: 503-641-1554

Eugene
Book Mark
PH: 503-484-0512
FAX: 503-484-3130

Portland
Powell's Technical Books
PH: 503-228-3906
FAX: 503-228-0505

PENNSYLVANIA
Doylestown
Village Green Bookstore
PH: 215-230-7610
FAX: 215-230-7615

Erie
The Erie Book Store
PH: 800-252-3354
FAX: 814-456-2702

Philadelphia
Bookstore of the University of Pennsylvania
PH: 215-898-4900
FAX: 215-898-6997

Pittsburgh
Book Center
University of Pittsburgh
PH: 412-648-2321
FAX: 412-648-1902

Scranton
Paperback Booksmith
PH: 717-346-9162

RHODE ISLAND
Providence
Brown Bookstore
PH: 401-863-3168
FAX: 401-863-2233

TEXAS
Arlington
Taylor's Technical Books
PH: 817-548-TECH

Austin
University Co-Op
PH: 512-476-7211

Dallas
Taylor's Technical Books
PH: 214-239-TECH

Houston
Brown Book Shop
PH: 713-652-3937
FAX: 713-652-1914

VIRGINIA
Blacksburg
University Bookstore, Virginia Tech
PH: 703-231-5991
FAX: 703-231-3410

Vienna
Computer Literacy Bookshops
PH: 703-734-7771
EMAIL: sales@tc.clbooks.com

WASHINGTON
Bellevue
University Bookstore
PH: 206-646-3300
FAX: 206-646-3340

Pullman
Students Book Corporation
PH: 509-332-2537
FAX: 509-332-8239

Seattle
Tower Books
PH: 206-283-6333
FAX: 206-285-2188

Tacoma
Tower Books
PH: 206-473-3362
FAX: 206-473-9141

WISCONSIN
Madison
University Bookstore
PH: 608-257-3784
FAX: 608-257-9479

Milwaukee
University of Wisconsin Milwaukee
PH: 414-229-4201
FAX: 414-229-6194

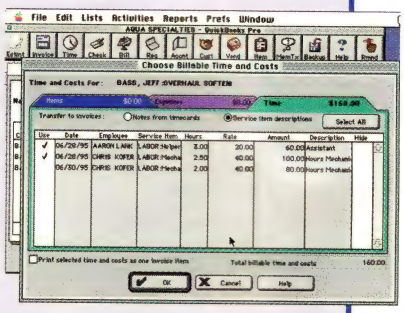
KEY=SF65BYL

WHAT'S NEW Software

PREVIEW SMALL-BUSINESS ACCOUNTING

Juggle Many Projects with QuickBooks Pro

QuickBooks Pro, the enhanced version of Intuit's small-business accounting program, integrates time-tracking, estimating, and job-costing features that are not normally found in inexpensive packages. The program is available in versions for Windows 3.1 and the Mac ($189 each); BYTE looked at a prerelease version of QuickBooks Pro for the Mac.



One intriguing feature is QuickBooks Pro's ability to maintain running time sheets for each employee, tallying the number of hours spent on a particular client's projects. Formerly, you had to track this information using a specialized application or spreadsheet or, worse, scrap paper. But with just a few mouse-clicks in QuickBooks Pro, you can transfer billable hours to invoices for individual jobs or clients. You can also create reports that evaluate the profitability of an employee, client, or specific project. The time sheets are simple to maintain and could be an invaluable tool for businesses that juggle several projects at once. In addition, time-sheet information readily flows to the payroll module for computing pay for wage-based employees.

Intuit
Menlo Park, CA
(800) 624-8742
(415) 322-0573
Circle 994 on Inquiry Card.

QuickBooks Pro also lets you produce estimates, a small-business chore that's typically performed on a spreadsheet. You can easily convert estimates to invoices and modify the invoices without changing the original estimates. The program also lets you generate reports that compare estimates with actual sales.

Like Quicken, QuickBooks Pro is designed for people who have minimal accounting skills but need to rapidly and economically manage their business finances. The program is powerful and multifaceted, but it's accessible to the novice. With QuickBooks Pro, you can focus your business on the talents that generate income rather than getting bogged down in managing a paper trail of invoices, estimates, and cost-accounting. —Chris Kofer

ON-LINE COMMUNICATIONS FOR WINDOWS 95

Among the features of Qmodem-Pro for Windows 95 version 2.0 ($129) are TAPI support, which allows the sharing of communications devices among multiple applications; MAPI support, which lets you transfer text, images, and files to major E-mail programs; OLE 2.0 support, which lets you drag a phone-book entry directly to the Windows 95 desktop and connect to that service right from the desktop by clicking on the icon; support for long filenames; and path support. A script language with QuickLearn capabilities lets you automate on-line sessions and create custom interfaces; it also contains a compiler, a debugger, and a syntax-highlighting editor.
Contact: Mustang Software, Bakersfield, CA, (800) 999-9619 or (805) 873-2500; http://www.mustang.com.
Circle 997 on Inquiry Card.

MUNICIPAL ENGINEERING OFFICE

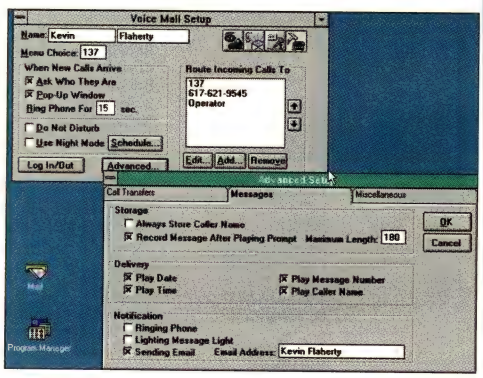
A CAD solution for the modeling, analysis, and design of water-distribution networks and wastewater-collection systems, Municipal Engineering Office ($5000) for Windows NT includes the InWater, InSewer, and Relational Information System components. InWater enables you to graphically model and analyze water-distribution systems with data transfer to and from analysis engines, such as KYPipe. A modeling solution for analyzing and designing wastewater collection, transport, and disposal systems, InSewer combines automated design and engineering tasks with relational-database capabilities. Relational Information System is a generic interface for communicating information across a networked environment. The package also includes DraftWorks, an automated drawing-production application.
Contact: Intergraph, Huntsville, AL, (800) 345-4856 or (205) 730-5499; http://www.intergraph.com.
Circle 1005 on Inquiry Card.

DISTRIBUTED SOFTWARE MANAGEMENT

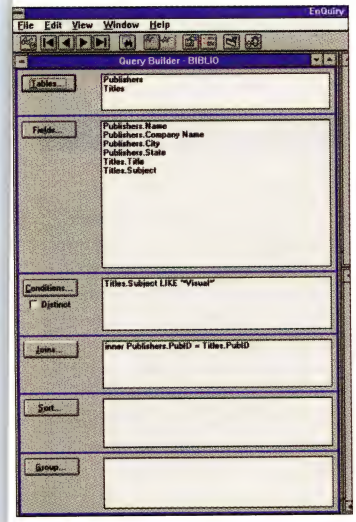
A software management solution designed for PC LANs, NetWizard 2.5 (10-user pack, $595) provides automated software and hardware inventory, software distribution, software metering and licensing, and remote configuration. NetWizard lets you install software on hundreds of desktops from a single location; generate scripts automatically using the Package Editor; use visual script editors to develop complex scripts without any programming; compress distribution packages for efficient transmission; and eliminate redundant software installation/update overhead.
Contact: Attachmate, Bellevue, WA, (800) 426-6283 or (206) 644-4010; http://www.attachmate.com.
Circle 998 on Inquiry Card.

32-BIT OLE CONTROLS FOR WINDOWS TELEPHONY ▼

Using Visual Voice for Win32 (for Windows NT, from $795; for Windows 95, from $495), you can create applications—including fax-on-demand, interactive voice response, and voice mail—that can interact with most data sources and networks. The program provides high-level interfaces to functions such as answering inbound calls, placing outbound calls, prompting for Touch-Tone input once calls are established, recording and playing back voice files, sending and receiving faxes, and integrating with a PBX to perform call-control functions. The Voice Workbench tool visually defines the telephony components of an application and generates the corresponding application logic. A 32-bit DLL interface allows 32-bit development environments that support DLLs to take advantage of Visual Basic's telephony features.



Contact: Stylus Innovation, Cambridge, MA, (617) 621-9545; http://www.stylus.com.
Circle 1009 on Inquiry Card.



CLIENT/SERVER CAPABILITIES FOR VISUAL BASIC ▲

EnQuiry ($395) lets Visual Basic programmers rapidly and visually build forms and queries without coding. With the Query Builder, you can graphically manage and control virtually all aspects of the SQL query-and-control layout process. The Query Advisor reveals the status of the query-building process as it proceeds, flagging errors and providing advice and guidance for correcting problems. The EnQuiry Form Preview displays the results of your queries and the way data is presented to users.
Contact: Progress Software, Crescent Division, Bedford, MA, (800) 352-2742 or (617) 280-4000; crescent@progress.com.

Circle 1002 on Inquiry Card.

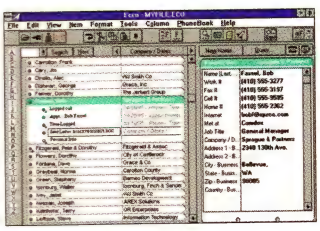
CASH-FLOW FORECASTS FOR EXCEL 5

PFP Maxima II for Excel 5 for Windows (US$199) formats your company's financial statements and calculates federal, state, and local taxes; interest; management bonuses; long-term loans; cash flows; bank-credit-line working limits; ratio analysis; and break-evens. You can add, delete, or change accounts where appropriate, and the program's report capabilities include up to 17 presentation-quality financial statements and supporting schedules (monthly and annually).
Contact: Pendock Mallorn, Toronto, Ontario, Canada, (416) 264-2126.

Circle 999 on Inquiry Card.

INTERNET INTEGRATION AND WORKGROUP COLLABORATION

Ecco Pro 3.0 ($175) adds more than 100 features, including an Internet Address Book; AutoAssign, an organizer that categorizes information into specific Ecco folders based on user-definable rules; and a correspondence manager, which lets you automatically send faxes, E-mail, and letters to any number of contacts simultaneously. Enhancements include Notepads for outlining the details of your projects, a Rolodex card interface, tabs to switch between views, revised menus and dialog boxes, icon balloon help, and a print coach for print layouts. The Internet Address Book comes pre-



configured with over 2000 gopher, World Wide Web, and FTP sites. While surfing the information highway, you can use the Shooter to send selected information from the Internet to Ecco Pro 3.0, where the information and its Internet address are stored. The Time and Expenses feature lets individuals and workgroups track expenses for activities such as projects and calls.
Contact: NetManage, Cupertino, CA, (408) 973-7171; http://www.netmanage.com.

Circle 1000 on Inquiry Card.

SOFTWARE FOR MOBILE WORKERS

Mobilizer for Windows (single-user package, $299) integrates office-mail, file, and database applications and mobilizes them for use on a remote laptop, giving mobile workers the flexibility to communicate over traditional wired phone lines or wireless telecommunications services. The product consists of four components. File Mobilizer allows transparent access to LAN network drives and lets you specify the files you want to mobilize. ConnectSoft's E-Mail Connection software lets you download, review, and respond to mail off-line through one integrated user interface. With Database Mobilizer, you can cache and query corporate databases in a store-and-forward manner using ODBC drivers. The Mobile Communications Manager automates connections over both wired and wireless communications services.

Contact: Digital Equipment, Littleton, MA, (800) 344-4825 or (508) 486-2254; http://www.digital.com/info/mobile.

Circle 995 on Inquiry Card.

Software Update

Conversions Plus 3.0 for Windows, the PC-to-Mac file-exchange utility, adds translators for TIFF, JPEG, GIF, BMP, PCX, and EPS graphics; Quattro Pro 5.0 and 6.0 and Lotus WK4 4.0 and 5.0 spreadsheets; WordPerfect 6.1; Microsoft Works 4.0 Macintosh; ClarisWorks 2.x, 3.x, Mac, and PC; and WordPerfect Works 2.0 Windows. The package also offers enhanced graphics capabilities and a file-preview feature. $149.
Contact: DataViz, Trumbull, CT, (800) 733-0030 or (203) 268-0030.

Circle 1011 on Inquiry Card.

A data-query, reporting, and analysis tool, **Forest & Trees 4.0** offers an expanded query capability, including the ability to conduct ad hoc queries without having knowledge of SQL or the target-database structure; data-analysis features, such as alarms, graphs, cross-tabs, and single-click data interpretation; and customization facilities. Administrative version, $995; Enterprise version, $790.
Contact: Trinzic, Redwood City, CA, (800) 952-8779 or (415) 591-8200.

Circle 1012 on Inquiry Card.

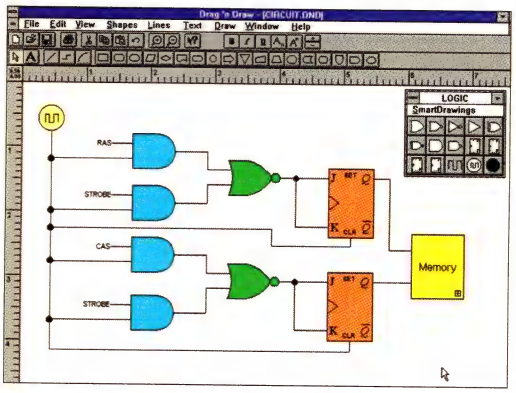
WinDelete 2.0 for Windows monitors application installation to enable better application removal, covers most types of applications and system-support files, previews its changes before making them, offers a one-step undo/restore feature, and has tools to facilitate better system management, such as intelligent uninstalling of more file types, effective management of system files, and personalized system tips and information. $49.95.
Contact: IMSI, San Rafael, CA, (800) 833-8082 or (415) 257-3000; http://www.imsisoft.com.

Circle 1013 on Inquiry Card.

WHAT'S NEW Software

CREATE DESIGNS AND DIAGRAMS ▼

Designed to meet your drawing and diagraming needs, Drag 'n Draw for Windows ($149) provides SmartDrawing Libraries that are aimed at the scientific, technical, and business communities; tools to simplify the drawing process from start to finish; and a system for customizing objects and drawings and linking them to other objects. Drag 'n Draw enables you to create such diagrams as electrical schematics, fish-bone charts, flowcharts, landscapes, network diagrams, organizational charts, time lines, quality-control diagrams, and space-planning and technical drawings.



Contact: DeltaPoint, Monterey, CA, (800) 446-6955 or (408) 648-4000; http://www.deltapoint.com.

Circle 1007 on Inquiry Card.

PC DIAGNOSTICS

With PC Certify Pro, you can conduct thorough diagnostic testing of IBM PC and compatible systems. The program features 10 test-group profiles, 18 command-line switches, and unlimited reporting. In addition to quick diagnostics, the system-load test can perform a 24-hour system burn-in in just 2.4 hours. The test roster includes all the major system components, including CPU, FPU, memory, motherboard, video adapter, serial and parallel ports, hard disks, disk drives, system load, keyboard, internal speaker, mouse, joystick, printer, SCSI, CD-ROM, and other devices, such as sound card, fax, and stacker. PC Certify Pro ($249) also comes with 11 diagnostics utilities to help you pinpoint system errors.

Contact: Landmark Research International, Clearwater, FL, (800) 683-6696 or (813) 443-1331; 71333.2735@compuserve.com.

Circle 1008 on Inquiry Card.

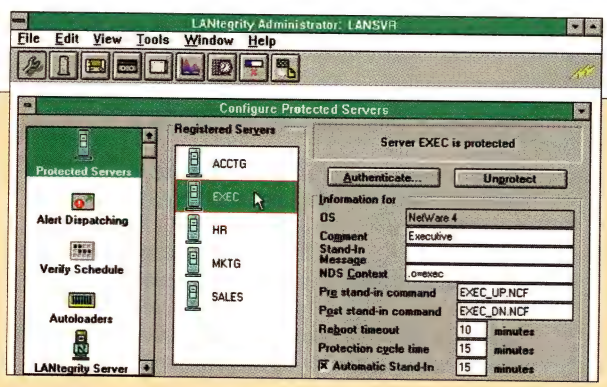
FREEHAND 5 FOR WINDOWS

A native 32-bit application for graphic design and illustration, FreeHand 5 for Windows ($595) comes with more than 500 fonts and 10,000 clip-art images and provides cross-platform graphic illustration. New features include an expandable architecture, style sheets, a spelling checker, search and replace, strike-through, highlighting, optional text-edit windows, an optional text ruler, and special effects. FreeHand 5 also supports text-handling capabilities, which let you lay out multipage brochures and advertisements, and floating palettes. Import/export capabilities let FreeHand open and place CorelDraw 3 and 5 files, as well as files from Illustrator.

Contact: Macromedia, San Francisco, CA, (800) 288-4797 or (415) 252-2000; http://www.macromedia.com.

Circle 1001 on Inquiry Card.

SERVER-FAULT RESILIENCE



Initially available for NetWare, LANtegrity (license for 100 users, $4950; for 1000 users, $11,500) is a hot standby solution that provides instant recovery for failed servers. The program continuously monitors all protected servers and can automatically stand in for any server within 15 seconds of detecting a failure. Users simply log in and access the same user accounts, files, and client software as if they were connected to their usual server. An Intelligent Data Vault feature maintains archival copies of all current and previous versions of files and manages the most active files in disk storage and all the current files in tape auto-loader storage. LANtegrity also lets you upgrade or reconfigure servers without disturbing users' access to their files.

Contact: Network Integrity, Marlborough, MA, (508) 460-6670.

Circle 996 on Inquiry Card.

Software Update

The Windows version of the relational database, **4th Dimension 3.5** provides built-in multitasking, a 4GL with more than 350 commands for customizing applications and adding extensions to databases, a graphical interface that supports Windows and the Mac, and an optional compiler that compiles code into machine language. $895.

Contact: ACI US, Cupertino, CA, (408) 252-4444.

Circle 1014 on Inquiry Card.

The Secure Workplace for OS/2 3.0, a product that provides workstation security, extended control of the Workplace Shell, and workplace management utilities, includes increased compatibility with OS/2 Warp; the ability to secure every object on the Workplace Shell, including disk and file objects; new audit-trail and user-authentication facilities; a new desktop-switching utility; and improved desktop management utilities. Standard edition, $59.95; Enterprise edition with 10-station-license minimum, $549.

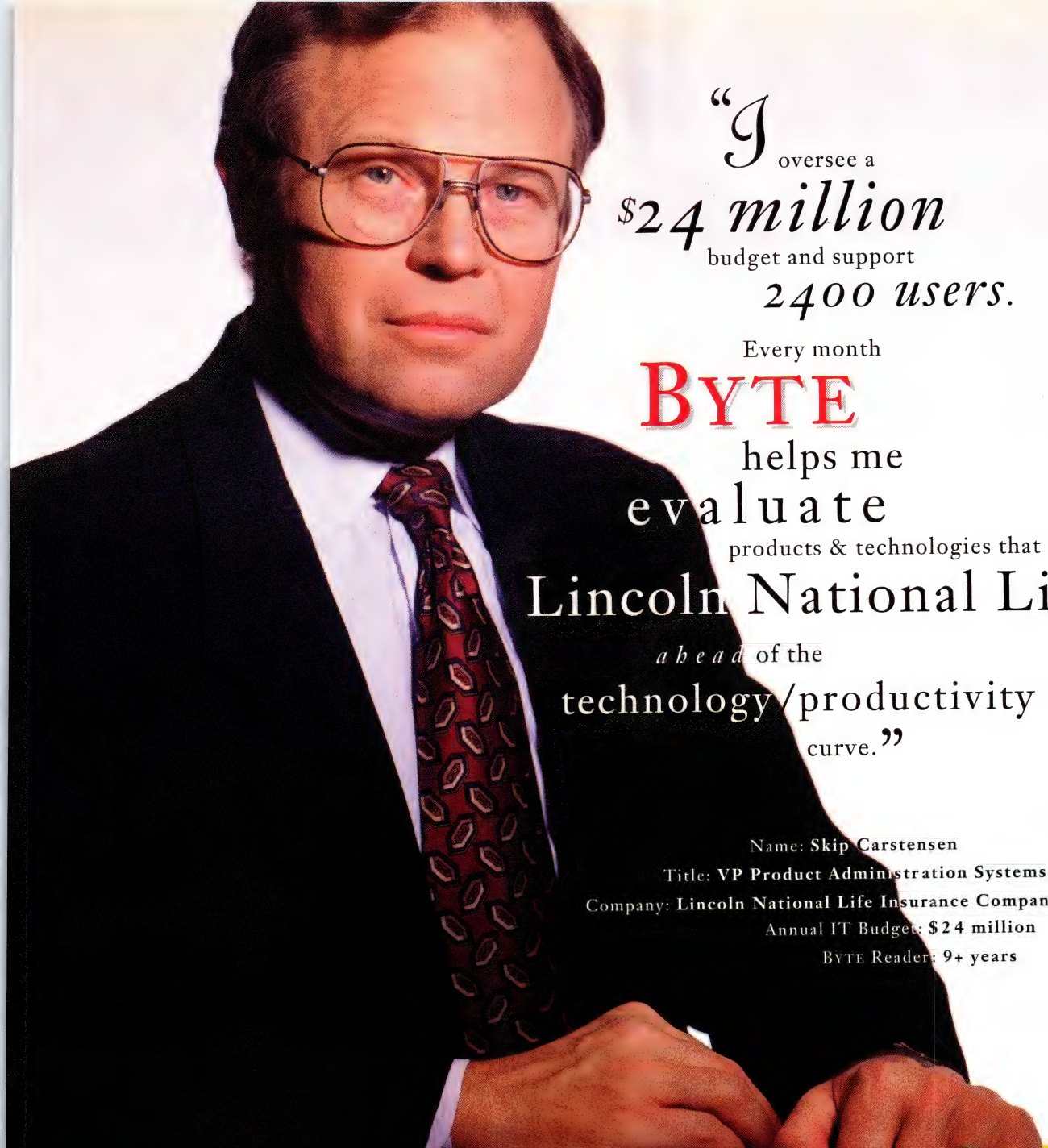
Contact: Syntegration, Chino, CA, (909) 464-9450; 73707.3331@compuserve.com.

Circle 1015 on Inquiry Card.

An analysis and presentation-graphics program, **Stanford Graphics 3.0** has been ported to Digital Equipment's Alpha systems running Windows NT. Enhancements include a Formula Visualizer, which graphically solves user-defined equations; custom line styles; speed improvements of 650 percent for data import and 150 percent for spreadsheet calculations; intelligent data axes for plotting time-series or financial data; and various graphics import and export options. $895.

Contact: Visual Numerics, Houston, TX, (800) 729-4723 or (713) 784-3131; http://www.vni.com.

Circle 1016 on Inquiry Card.



"I oversee a $24 million budget and support 2400 users.

Every month BYTE helps me evaluate products & technologies that keep Lincoln National Life *ahead* of the technology/productivity curve."

Name: **Skip Carstensen**
Title: **VP Product Administration Systems**
Company: **Lincoln National Life Insurance Company**
Annual IT Budget: **$24 million**
BYTE Reader: **9+ years**

BYTE readers set the agenda for corporate Information Technology purchases. Their recommendations can take your products to the top – or leave them at the door. Why? Because BYTE readers are the *technology experts.* They define the short list. They specify brands. They tell the buyers what to buy.

Want to get your product in front of Skip? Advertise in BYTE. And reach more than a half-million technology experts who drive the IT buy.

BYTE Because the *Experts* Decide.

See for Yourself: To find out more about the buying power of BYTE readers, call 603-924-2618 and ask to see our *Information Technology Buying Process* video.
BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

No Matter Where Your Application Takes You

Quatech PC Cards Are There.

Quatech, Inc. manufactures a complete line of quality data acquisition and communication PC Cards made in the U.S.A. Each card is PC Card Specification 2.1 compliant and includes enabler and client driver software.

Data Acquisition PC Cards

- 24 digital input/output card
- 12 and 16-bit analog input cards with 16 channels of programmable scanning and gain selections
- Eight channel analog output card available in unipolar and bipolar versions
- DAQDrive included, optional VisualDAQ

Communication PC Cards

- Single and dual channel RS-232
- Single and dual channel RS-422/485
- One channel RS-232 and one channel RS-422/485
- Multi-protocol adapter supports HDLC and SDLC
- Parallel port/enhanced parallel port card
- DOS, Windows, and SCO UNIX compatible

QUATECH

Call **800-553-1170** today for complete information and a FREE 1995 Product Handbook.

Quatech, Inc. 662 Wolf Ledges Parkway, Akron, OH 44311. **International Distributors: Australia**/Interworld Electronics & Computer 61-3-95635011, **Austria**/Megadata 43-1-523 42 12, **Belgium**/Acal NV/SA 32-27-205983, **Brazil** (Sao Paulo)/Intercomp 55-11-8532733, **Brazil** (Rio de Janeiro)/Medusa Sistemas e Automacao 55-21-2554745, **Canada**(Western)/Interworld Electronics 800-663-6001(Toronto office 800-465-0164), **China**/Quatech China 86-1-205-9030, **Denmark**/Jes Rasmussen ApS. 45-4281-6838, **Finland**/Lab Hi-Tech OY 358-0-682-1255, **France**/Elexo 33-1-69537020, **Germany**/Jupiter Electronic Systems GMBH 49-61-8175041, **Hong Kong**/Brio Technology Ltd. 852-581-1111, **India**/Comsquare Network Pvt. Ltd. 91-11-224-5159, **Israel**/Milivision Ltd. Div. 972-9-500623, **Italy**(Non-PCMCIA)/N.C.S. Computer Italia 39-331-770016, **Italy**(PCMCIA Only)/Kernel Consulting S.r.l. 39-6-77207000, **Japan**/Nictrix Corp. (New Jersey) 201-947-2220, **Korea**/Sam Boo Systems 82-2-5384001, **Netherlands**/ACAL Auriema 31-40-502602, **New Zealand**/Advanced Portable Technologies 64-4-3852838, **Pakistan**/Rastek (PVT) Limited 92-21-4551881, **Saudi Arabia**/Integrated Computer Operations 966-3-895-1827, **Singapore**/Bliss Services Pte Ltd. 65-338-1300, **South Africa**/Eagle Technology 27-21-234943, **Spain**/Santa Barbara SA 34-3-418-81-16, **Sweden**/Systec 46-13-310140, **Switzerland**/Technosoftware 41-64-519040, **Turkey**/Logic Group 90-212-2747197

Circle 94 on Inquiry Card (RESELLERS: 95).

BYTE BUYER'S GUIDE

Essential Products and Services for Technology Experts

Mail Order

Top mail-order vendors offer the latest hardware and software products at the best prices.

202

Hardware/Software Showcase

Your full-color guide to in-demand hardware and software products, categorized for quick access.

230

Buyer's Mart

The BYTE classified directory of computer products and services, organized by subject so you can easily locate the right product.

239

COMPUTER DISCOUNT WAREHOUSE™

COMPUTER DISCOUNT WAREHOUSE™

U.S. Robotics

PRICE DROP!

Sportster Vi 28.8 Faxmodem with voice mail

◆ Data: V.34 and V.FC™ (28.8K bps) and V.32bis (14.4K bps) ◆ Fax: 14.4K bps send/receive ◆ V.42/MNP 2-4 error control and V.42 bis/MNP 5 data compression for throughput up to 115.2K bps ◆ Digitally records voice messages ◆ Includes voice mail, fax and data communications software for Windows ◆ 5 year limited warranty

Internal	$208.70	CDW 54076
External	$225.33	CDW 55428

WHY PAY RETAIL?

CDW® Sells For Less

intel

PRICE DROP!

Intel Pentium™ OverDrive® Processor

Power up to a new performance level

Boost your system's overall performance and run software at amazing speeds with an Intel Pentium™ OverDrive® processor. For Intel486™ SX, SX2, DX, DX2, 25MHz and 50MHz CPU-based PCs.**

ONLY $285.37 CDW 50521

Call for compatibility information.

HARDWARE, SOFTWARE & PERIPHERALS AT DISCOUNT PRICES

NETWORKING PRODUCTS

NOVELL

Netware V4.1

5 User CD	669.72
10 User CD	1519.69
25 User CD	2244.74
50 User CD	3028.97
100 User CD	4229.98

Netware V3.12

5 User 3.5"	619.93
10 User 3.5"	1409.77
25 User 3.5"	2082.50
50 User 3.5"	2809.96
100 User 3.5"	3925.82

Call for Pricing on Novell NetWare upgrades!

3Com®

3C503 Etherlink II coax	159.44
3C509B Etherlink III coax	114.14
3C509B Etherlink III coax 5pk	479.65
3C509B Etherlink III 10BT	111.14
3C509B Etherlink III 10BT 5pk	442.36
3C509B Etherlink III combo	123.77
3C509B Etherlink III combo 5pk	526.78
3C579 Etherlink EISA coax	229.91
3C579 Etherlink EISA 10BT	229.91
3C1627 12 port Linkbuilder 10BT	619.44

ARTISOFT

NodeRunner 2000A	215.58
NodeRunner 2000T	169.05
NodeRunner 2000C	169.05
NodeRunner/SI 2000A	87.13
NodeRunner/SI 2000T	73.62
LANtastic V6.0	79.50
LANtastic V6.0 5 user	329.87
LANtastic V6.0 Starter Kit	229.13
Central Station II	389.13
Simply LANtastic starter kit	163.79
T-Runner 8 port 10BT	179.99
T-Runner 12 port 10BT	199.82

ASP
ASP COMPUTER PRODUCTS, INC.

Multiprotocol print server 10BT HP MIO	249.93
Multiprotocol print server 10BT pocket	287.30
Multiprotocol 2 printer server combo	309.61
Multiprotocol 4 printer server combo	499.82
SNAP starter kit-2 computers, 1 printer	119.10
SNAP add-on transmitter	49.50
Fax Authority Solo network fax server	499.86

IBM

Token Ring Adapter II 16/4 ISA	399.88
Token Ring Auto Adapter 16/4 ISA	257.76
IBM Token Ring MAU	398.42

intel

EtherExpress PRO/100Mbps PCI	219.19
EtherExpress PRO/100Mbps EISA	246.52
EtherExpress PRO/100Mbps PCI 5pk	998.36
EtherExpress PRO/10 Flsh 10BT	108.01
EtherExpress PRO/10 Flsh 10BT 5pk	419.98
EtherExpress PRO/10 Flsh combo	115.07
EtherExpress PRO/10 Flsh combo 5pk	472.00
EtherExpress 16 coax	99.33
EtherExpress 16 coax 5pk	454.13
EtherExpress 16 10BT	99.33
EtherExpress 16 10BT 5pk	469.50
EtherExpress 16 10BT 20pk	1698.38
EtherExpress MCA 10BT	166.52
EtherExpress 16 combo	116.77
EtherExpress 16 combo 5pk	549.72
EtherExpress Flsh 10BT	111.88
EtherExpress Flsh 10BT 5pk	519.90
EtherExpress Flsh combo	129.79
EtherExpress Flsh combo 5pk	591.05
TokenExpress 16/4	326.96
NetportExpress II 10BT	368.85

MICRODYNE

Eagle NE2000+ coax	76.63
Eagle NE2000T+ 10BT	69.45
Eagle NE2000+ combo	85.40
IRMAtrac 4/16Mpbs ISA Convertible	439.30
IRMAtrac 4/16Mbps ISA Hardtop	277.81

NETWORKING PRODUCTS

SMC®

EtherEZ 10BT	94.47
EtherEZ coax	94.47
EtherEZ combo	107.06
Etherpower 10BT PCI	139.81
Etherpower coax PCI	149.97
Etherpower2 10BT	252.26
Etherpower2 combo	271.05
Ultra16 Ethernet coax	94.96
Ultra16 coax 6pk	509.88
Ultra16 Ethernet 10BT	96.10
Ultra16 10BT 6pk	459.23
Ultra16 10BT 24pk	1573.71
Ultra16 Ethernet combo	107.71
TigerHub TP6 6 port + AUI	169.78
TigerHub TP6B 6 port + BNC	189.83
TigerHub TP12 12 port + AUI	379.79
3608 Ethernet 8 port hub 10BT	298.85
3512 Ethernet 12+2 port hub 10BT	548.55
PC600WS ARCNET coax	119.93
ARCNET 8 port active hub coax	229.41
TokenCard Elite 16/4	221.27

THOMAS-CONRAD

TC5143 Ethernet 10BT	71.60
TC5143 Ethernet 10BT 6pk	399.94
TC6242 ARCNET 8-bit coax	66.86
TC6245 ARCNET coax	179.99
TC5055 Ethernet 8 port hub 10BT	338.28
TC4045 Token Ring 16/4	213.24

CDW Carries the Complete Line of TCNS Products. Call for Details!

TERMINALS

Link MC5 amber/green/white	252.77
Link MC80 14" color	419.50
Wyse 55 amber/green/white	223.21
Wyse 60 amber/green/white	279.60
Wyse 160 amber/green/white	329.88

Xircom

PE310BC pocket Ethernet coax	317.26
PE310B2 pocket Ethernet coax	277.51
PE310BT pocket Ethernet 10BT	277.51
PT316CTP pocket Token Ring III	475.83
PPX03 Parallel port multiplexor	77.80
PS-CE2 PCMCIA Ethernet 10BT	158.69
PS-CE2 PCMCIA Ethernet combo	206.15
PS-CE2 PCMCIA Token Ring	409.84

TAPE & REMOVABLE MEDIA DRIVES

COLORADO MEMORY SYSTEMS INC.

Jumbo 350 internal	139.87
Jumbo 700 internal	199.88
Jumbo 1400 internal	309.48
Trakker 250 parallel port	268.77
Trakker 350 parallel port	284.91
Trakker 700 parallel port	337.47
T1000 800MB Travan	195.38
Powertape 2.4GB SCSI internal	937.58
Powertape 2.4GB SCSI external	1077.99

iomega

Zip drive 100MB parallel interface	199.00
Zip drive 100MB SCSI interface	199.00
Zip disks 100MB, 3pk	49.95
Ditto 420MB tape drive internal	99.00
Ditto 800MB Travan tape drive internal	199.00

MICROSOLUTIONS

Backpack 3.5" 1.44MB floppy parallel	146.32
Backpack 800MB Travan parallel	296.12
Backpack 250MB tape backup parallel	259.65

TAPE & REMOVABLE MEDIA DRIVES

CONNER

Tape*Stor 250MB internal	118.28
Tape*Stor 420MB internal	139.36
Tape*Stor 420MB parallel	309.48
Tape*Stor 800MB Travan internal	232.77
Tape*Stor 800MB Travan parallel	383.81
Tape*Stor 850MB internal	219.87
Tape*Stor 850MB parallel	365.25
Tape*Stor 4GB internal IDE	539.78

Mountain

FileSafe TD-350, 350MB internal	104.33
FileSafe 800MB Travan internal	174.50

SyQuest

EZ135 135MB internal IDE interface	198.99
EZ135 135MB external SCSI interface	239.49
EZ135 135MB cartridge	19.97

MULTIMEDIA AND CD-ROM

Creative Labs

Multimedia Home CD 4x kit internal	448.99
Blaster CD 4x kit	213.89
Sound Blaster Value CD 4x kit	298.99
Sound Blaster Digti Schoolhse CD 4x kit	326.72
Sound Blaster Discovery CD 4x kit	346.33
Sound Blaster Performance CD 4x kit	428.99
Phone Blaster 14.4K internal w/software	188.18
Modem Blaster 14.4K	82.26
Modem Blaster 28.8K	202.55
Sound Blaster 16 value edition (IDE)	99.99
Sound Blaster 16 SCSI-2	178.99
Sound Blaster AWE32	298.99
Sound Blaster AWE32 (IDE)	168.99
Wave Blaster II GamePak	154.50

Microsolutions 4X CD parallel w/sound	488.15
Advent PP570 speakers 35W	245.97
Advent PP622 sprks/subwoofer	188.64
Diamond 4000 Quad CD kit internal	289.76
Diamond 5000 Quad CD kit internal	389.82
Jensen JPS35 speakers 5W	54.88
Jensen JPS45 speakers 10W	89.93
Logitech SoundMan Wave	119.49
Microsolutions 4X CD parallel	354.88
NEC 3Xp Plus	384.54
NEC 3Xp Plus Kit	458.93
NEC 6Xi	456.14
NEC 6Xe	547.55
Pioneer DRM624X 6 disc 4X changer	574.46
Plextor 4plex quad external	559.85
Plextor 4plex quad internal	427.55
Plextor 6X internal	499.87
Sigma Designs RealMagic Lite	258.59
Sigma Designs RealMagic MPEG	366.41
Sigma Designs RealMagic CD Kit	635.81
Sony 4X internal w/IDE interface	229.63
Sony 4X internal w/SCSI-2 interface	315.62
Teac SuperQuad 4X internal	194.15
Toshiba 3601 SCSI 4X internal	309.86
Turtle Beach Monte Carlo	84.71
Turtle Beach Tropez	193.67
Turtle Beach Monterey	316.94

DIGITIZERS & SCANNERS

CalComp

DB III 12X12 4 button	299.67
DB III 12X12 16 button	299.97
DB III 12X12 pressure pen	389.97
Drawing Slate II 12X12 4 button cordless	228.98

DIGITIZERS & SCANNERS

EPSON

ES-1000C	768.44
ES-1200-ProPC	1295.72

HEWLETT PACKARD

ScanJet 3P	319.57
ScanJet 3P document feeder	209.49
ScanJet 3C W/ISA interface	936.65
ScanJet IICX document feeder	468.50
ScanJet IICX transparency adapter	633.26

MICROTEK

Scanmaker IIG grayscale	249.29
Scanmaker II color	396.65
Scanmaker IISP color	495.32
Scanmaker IIHR color	749.98
ScanMaker III color	2409.95
Scanmaker 35T slide scanner	698.59

Summagraphics.

Summasketch III 12 X 12 16 button	218.58
Summasketch III 18 X 12 4 button	488.33

MONITORS

Mag Innovision DX15F	379.88
Mag Innovision DX17F	669.78
Mag Innovision MXP17F	876.67
Mag Innovision MX21F	1689.47
Magnavox CM2089 14" .28	237.56
Magnavox CM2099 14" .28 NI	249.57
Magnavox CM2015 15" 1024	322.79
Magnavox CM4015 15" 1280	375.84
Magnavox CM4017 17" .31	609.25
Magnavox CM4018 17" .28	674.57
Magnavox 20CM64 20"	1087.09
NEC 3FGe 15"	409.75
NEC XV14 14"	311.63
NEC XV15 15"	433.03
NEC XV17 17"	769.43
NEC XE15 15"	575.77
NEC XE17 17"	998.26
NEC XE21 21"	1779.24
NEC XP15 15"	579.68
NEC XP17 17"	1095.36
NEC XP21 21"	2169.43
Samsung 15GLi 15"	409.74
Samsung 17GLi 17"	737.71
Samsung 17GLsi 17"	934.80
Sony CPD-1425 14"	318.33
Sony 15SF 15"	489.27
Sony 17SF1 17"	879.48
Sony 20SE1 20"	1929.28
ViewSonic 15GS 15"	435.20
ViewSonic 17GS 17"	757.64
ViewSonic 21PS 21"	1693.70

VIDEO BOARDS

ADS VGA to TV Elite internal	134.89
ADS VGA to TV Elite external	198.83
ATI Graphics Xpression ISA 2MB	189.36
ATI Graphics Xpression VLB 2MB	189.36
ATI Graphics Xpression PCI 2MB	189.36
ATI Graphics Pro Turbo ISA 2MB	319.97
ATI Graphics Pro Turbo VLB 2MB	319.97
ATI Graphics Pro Turbo PCI 2MB	319.97
ATI Graphics Pro Turbo PCI 4MB	449.68
Diamond SpeedStar Pro ISA 1MB	95.69
Diamond SpeedStar 64 ISA 2MB	199.00
Diamond SpeedStar 64 ISA 1MB	153.40
Diamond Stealth Video VLB 2MB	238.98
Diamond Stealth Video PCI 2MB	237.89
Intel Smart Video Recorder Pro	398.99

If You Find a Better Price, Call CDW® Before You Buy (800) 959-4CDW

NASDAQ

BUY WITH CONFIDENCE
CDW® IS A NASDAQ TRADED COMPANY
TICKER SYMBOL CDWC
D & B rated 5A1
Duns 10-762-7952

No surcharge for credit cards

Credit Card charges are not submitted until time of shipment. Freight is calculated as the carrier's actual freight charge plus insurance and packaging material. The cost of insurance is 0.35% (0.0035) of the order total. Packaging materials will not exceed $4.00 per 1 package order or $6.00 per multi-package shipment. For your protection we ship only to your verified billing address. Non-defective returns subject to restocking fee. Allow 10 business days for shipping when paying by personal check. Software, chips and other electronic components are not returnable. All pricing subject to change. ™ - Trademarks of all companies listed in this ad. Not responsible for typographical errors.

CDW® TELEPHONE HOURS
Sales 7:00 -9:00 CDT Mon-Fri.
9:00-5:00 CDT Sat.
Tech Support for Customers
8:00-7:00 CDT Mon-Fri.
9:00-5:00 CDT Sat.

MOST ORDERS SHIP THE SAME DAY

CDW Computer Centers, Inc. • 1020 E. Lake Cook Road • Buffalo Grove, IL 60089

Byte 10/95

COMPUTER DISCOUNT WAREHOUSE™

SyQuest

NEW!

EZ135 Drive™
Affordable high-performance data storage

✔ Capacity: 135MB on one formatted 3.5" EZ135 cartridge ✔ Seek time: 13.5ms, up to 2.4MB/second sustained transfer rate ✔ IDE, SCSI (SCSI host adapter sold separately) and parallel port configurations ✔ Includes one EZ135 cartridge and data-management software ✔ Small, lightweight design: 1" x 4" x 5.91", 1lbs ✔ 2 year warranty

Internal IDE ..... **$198.99** CDW 55470

External SCSI ..... **$239.49** CDW 55471

External parallel ..... **CALL!**

WHY SETTLE FOR LESS?

CDW® SERVICES YOU BETTER

TOSHIBA

FREE!* $150 of Accessories

T2110CS
Value-priced 75MHz notebook

■ IntelDX4™ 75MHz CPU ■ 4MB RAM, 330MB hard drive ■ 10.4" dual-scan color display ■ Accelerated local bus video ■ AccuPoint™ integrated pointing device ■ Internal AC adapter, no bulky "brick" required

PRICE DROP! ..... **$1999.80** CDW 54863

** Purchase a Toshiba Satellite T2110CS between 8/1/95 and 9/30/95 and receive up to $150 off your choice of accessory products purchased on the same invoice. Other significant restrictions apply, call your CDW Account Executive for details.*

CDW® CARRIES OVER 20,000 PRODUCTS. IF YOU DON'T SEE IT, CALL!

COMPUTERS

TOSHIBA

T2100 DX2/50 250MB mono 1258.33
T2110CS DX4/75 330MB pas color 1999.80
T2130CS DX4/75 500MB pas color 2524.52
T2130CT DX4/75 500MB act color 3036.59
T2150CDS DX4/75 500MB pas color CD 2966.16
T2150CDT DX4/75 500MB act color CD 3669.85
400CS 5/75 772MB pas color 3547.91
400CDT 5/75 772B act color CD 4366.31
Portege 610CT 5/90 720MB act color 4338.05

AST

Ascentia portables

Ascentia 910N 4/75 510MB pas color 2526.67
Ascentia 910N 4/75 510MB act color 3169.81
Ascentia 910N 4/75 700MB act color 3359.00
Ascentia 950N 5/75 500MB pas color 3348.81
Ascentia 950N 5/75 800MB pas color 3636.46
Ascentia 950N 5/75 1.2GB pas color 4065.11
Ascentia 950N 5/75 800MB act color 4719.13
Ascentia 950N 5/75 1.2GB act color 5162.24

Advantage! Adventure desktops

Advantage! 814 5/100 1.2GB 16MB CD ..... CALL!
Advantage! 818 5/133 1.6GB 16MB CD ..... CALL!

Bravo MS desktops

5/75 8MB, 850MB WIN 95 ..... CALL!
5/75 8MB, 850MB CD WIN 95 ..... CALL!
5/75 16MB, 1.2GB WIN 95 ..... CALL!
5/100 8MB, 850MB WIN 95 ..... CALL!
5/100 8MB, 850MB CD WIN 95 ..... CALL!
5/100 16MB, 1.2GB WIN 95 ..... CALL!
5/120 16MB, 1.2GB WIN 95 ..... CALL!
5/120 16MB, 1.2GB CD WIN 95 ..... CALL!
5/133 16MB, 1.2GB WIN 95 ..... CALL!

Bravo MS-T mini-towers

5/75 8MB, 850MB WIN 95 ..... CALL!
5/75 8MB, 850MB CD WIN 95 ..... CALL!
5/75 16MB, 1.2GB WIN 95 ..... CALL!
5/100 8MB, 850MB WIN 95 ..... CALL!
5/100 8MB, 850MB CD WIN 95 ..... CALL!
5/100 16MB, 1.2GB WIN 95 ..... CALL!
5/120 16MB, 1.2GB WIN 95 ..... CALL!
5/120 16MB, 1.2GB CD WIN 95 ..... CALL!
5/133 16MB, 1.2GB WIN 95 ..... CALL!

IBM

ThinkPad portables

360CE DX2/50 340MB act color 3099.00
360CE DX2/50 540MB act color 3449.00
701CS DX4/75 540MB pas color 3449.00
701CS DX4/75 360MB pas color 3149.00
701C DX4/75 360MB act color 3699.00
701C DX4/75 540MB act color 3999.00
755C DX4/75 340MB act color 3547.00
755CSE DX4/100 340MB pas color 3499.00
755CSE DX4/100 540MB pas color 3849.00
755CE DX4/100 540MB act color 4649.00
755CE DX4/100 810MB act color 5099.00
755CD DX4/100 540MB act color, CD 5649.00
755CD DX4/100 810MB act color, CD 6099.00
755CX (SBJ) 5/75 540MB act color 4749.00
755CV 5/75 540MB act color 5799.00
755CX 5/75 810MB act color 6249.00
755CV 4/100 540MB act color 6099.00
755CDV 4/100 810MB act color CD 7549.00

Aptiva

Aptiva 535 DX2/66 540MB 1349.00

PC300 Series desktops

PC300 5/75 8MB, 540MB 1823.00
PC300 5/90 16MB, 850MB 2685.00
PC350 5/75 8MB, 540MB 1879.00
PC350 5/75 16MB, 850MB 2339.00
PC350 5/90 16MB, 850MB 2743.00
PC750 5/90 16MB, 540MB 2961.00
PC750 5/90 16MB, 540MB, CD 3565.00
PC700 5/120 16MB, 1GB 4135.00
PC750 5/133 16MB, 1GB 4307.00

NEC

Versa 2000D 4/75 4MB, 350MB dual clr 1899.57
Versa 2000C 4/75 4MB, 350MB act clr 2244.70
Versa 2000C 4/75 8MB, 350MB act clr 2489.73
Versa 2000C 4/75 8MB, 540MB act clr 2678.82
Versa 4000D 5/75 540MB dual clr CD 3799.00
Versa 4000TC 5/75 720MB act color 4199.00
Versa 4000TC 5/90 720MB act color CD 4899.00
Versa 4000HC 5/90 810MB hi-res clr 5099.00
Versa M DX4/75 540MB hi-res clr 3319.38
Versa M DX4/100 540MB hi-res clr 3876.24
Versa M DX4/100 810MB hi-res clr 4249.87
Versa M DX4/75 340MB true clr 2799.49
Versa M DX4/100 540MB true clr 3426.27
Versa P 5/75 540MB hi-res clr 4619.83
Versa P 5/75 810MB 9.5" hi-res clr 4898.73
Versa P 5/75 540MB act clr 4647.39
Versa P 5/75 810MB act clr 5029.66
Versa P 5/75 810MB 10.4" hi-res clr 5266.15

COMPUTERS

TEXAS INSTRUMENTS

TM4000M DX4/75 455MB dual color 2499.78
TM4000M DX4/75 524MB act color 2848.00
TM4000M DX4/100 524MB 10.4"act clr 3529.84
TM5000 5/75 524MB dual color 3868.65
TM5000 5/75 810MB act color 4539.22
TM5000 5/90 1.2GB act color ..... CALL!

DOT MATRIX & LASER PRINTERS

OKIDATA

184 Turbo 225.07
ML320 ..... 299.88
ML320 ..... 299.88
ML321 ..... 427.40
ML380 ..... 212.43
ML395 ..... 976.32
ML395C 1081.43
ML520 ..... 382.82
ML521 ..... 509.63
ML590 ..... 437.54
ML591 ..... 592.12
Pacemark 3410 1266.49
OL400E 349.38
OL410E 516.95
OL410E/PS 759.86
OL810 ..... 904.98
OL810E 769.33
OL830 Plus 1076.51
OL1200 ..... 1115.88
OKIJET 2010 ..... 367.77

Canon

BJ30 mono 259.88
BJC70 color 355.65
BJ100 ..... 175.86
BJ200ex 199.70
BJ230 ..... 391.55
BJC600e color 471.99
BJC4000 720dpi + color 348.78

EPSON

AP2250 ..... 96.64
AP3250 ..... 146.45
AP3260 ..... 167.82
LX300 ..... 174.32
FX870 ..... 303.95
FX1170 ..... 405.23
LQ1070+ 409.64
LQ870 ..... 448.43
LQ1170 ..... 689.85
LQ2550 ..... 965.08
DFX5000 Plus 1528.29
DFX8000 ..... 2559.89
Stylus 300 ..... 183.16
Stylus 800+ 215.47
Stylus 1000 ..... 479.34
Stylus Color 529.53
ActionLaser 1100 ..... 383.62
ActionLaser 1400 ..... 495.53

LEXMARK LASER PRINTERS

WinWriter 400 laser 755.03
WinWriter 600 laser 999.00
ValueWriter 300 (4037 5E 5PPM) 644.87
4039 10 Plus 10ppm 1218.36
Optra R 12ppm 1419.57
Optra Rx 16ppm 1988.33
ExecJet IIc 293.76

Panasonic

1150 ..... 134.02
2023 ..... 182.98
2130 ..... 204.60
2135 Color 247.53
3123 ..... 251.68
4400 Laser 454.90
5400 Laser 388.55
KX-SP100 printer/fax/copier 776.54

TEXAS INSTRUMENTS

microLaser 600 ..... 865.10
microLaser Pro 600 PS23 ..... 1197.02
microLaser Pro E 1365.49
microLaser Power Pro 600 PS65 ..... 1599.76

HEWLETT PACKARD

OfficeJet inkjet fax/copier/printer 698.55
DeskJet 320 portable 359.28
DeskJet 540 ..... 219.49
DeskJet 600 ..... 299.48
DeskJet 660C 397.32
DeskJet 850C 549.91
DeskJet 1600C 1369.07
DeskJet 1600CM 1992.48
LaserJet 5P 899.77
LaserJet 4 Plus 1449.96
LaserJet 4Si 2998.95
LaserJet 4V 1967.38
LaserJet Color 5929.62

COSTAR

LabelWriter XL WIN 139.86
LabelWriter XL Plus WIN 224.89

HARD DRIVES & CONTROLLERS

Maxtor

270MB Fast-ATA 151.08
345MB SCSI-2 ..... 174.50
425MB Fast-ATA 155.76
540MB Fast-ATA 177.67

MICROPOLIS

4221 2GB SCSI-2 ..... 965.18
1936 3GB SCSI-2 ..... 958.89
3243 4.3GB SCSI-2 ..... 1499.87

CONNER

425MB IDE 152.25
540MB IDE 209.40
850MB Fast-ATA 259.89
1.27GB Fast-ATA 299.96

All Conner drives listed include complete installation hardware and software.

Seagate

428MB Fast-ATA 146.39
545MB Fast-ATA 174.50
855MB Fast-ATA2 ..... 209.40
1GB Fast-ATA2 ..... 286.59
1GB SCSI-2 ..... 495.32

WESTERN DIGITAL

Caviar 540MB EIDE 179.85
Caviar 853MB EIDE 211.68
Caviar 1.2GB EIDE 315.30

CONTROLLERS

Acculogic SIDE-3+ w/on-board BIOS 48.90
Acculogic SIDE-4+ w/par, 2ser, game 35.06
Acculogic SIDE-4VL EIDE, 16550 serial 89.76
Acculogic ISApport SCSI-2 ..... 126.49
Adaptec AVA1505 SCSI-2 CD Kit 54.95
Adaptec AHA1542CF SCSI-2 ..... 265.45
Adaptec AVA2825 VLB SCSI-2/EIDE 166.87
Adaptec 2842 VLB SCSI-2 ..... 249.83
Promise 2300+ EIDE VLB 59.87

MODEMS & COMMUNICATIONS

U.S. Robotics

SPORTSTER MODEMS

14.4K internal w/fax 94.81
14.4K external w/fax 111.00
Vi 14.4K internal w/fax & voice 113.59
Vi 14.4K external w/fax & voice 133.78
V.34 28.8K internal w/fax 179.88
Vi DSVD V.34 internal w/fax & voice 278.82
V.34 28.8K external w/fax 199.86
Vi 28.8K internal w/fax & voice 208.70
Vi 28.8K external w/fax & voice 225.33

COURIER MODEMS

V.34 internal w/fax 387.60
V.34 external w/fax 422.32

Hayes

ACCURA 144 internal w/fax 91.87
ACCURA 144 external w/fax 111.18
ACCURA 288 V.34 internal w/fax 183.76
ACCURA 288 V.34 external w/fax 218.88
OPTIMA 144 external w/fax 374.30
OPTIMA 144 pocket w/fax 312.59
OPTIMA 288 V.34 internal w/fax 365.14
OPTIMA 288 V.34 external w/fax 419.44

PRACTICAL PERIPHERALS

14.4 internal w/fax 73.85
14.4 Mini Tower w/fax 89.76
V.34 28.8 internal w/fax 196.59
V.34 28.8 Mini Tower w/fax 209.64
Practical Pro Series ..... CALL!

BOCA

Online Express 14.4 internal w/fax 64.25
Online Express 14.4 external w/fax 79.78
V.34 28.8 internal w/fax 159.00
V.34 28.8 external w/fax 205.00

MICROCOM

Deskporte ES 14.4 ..... 146.39
Deskporte Fast ES V.34 28.8 ..... 179.94
Deskporte Fast EP V.34 28.8 ..... 239.99

ZOOM

V.34 FaxModem internal 142.89
V.34 FaxModem external 188.97
Voice FaxModem VFP 14.4VH internal 94.32
Voice FaxModem VFX 14.4V external 148.30
14.4 V.32bis w/fax internal 76.74
14.4 V.32bis w/fax external 115.16

BATTERY BACKUP AND UPS

American Power Conversion

Back UPS Pro 280 Plug and Play 183.43
Back UPS Pro 420 Plug and Play 249.79
Back UPS Pro 650 Plug and Play 309.74
SmartUPS 700 ..... 347.26
SmartUPS 1000 ..... 516.64
SmartUPS 1400 ..... 597.74
SmartUPS 2200 ..... 1109.69
SmartUPS 3000 ..... 1757.74
SurgeArrest Network 33.25
SurgeArrest Pro 29.45
SurgeArrest Network + Phone 49.98
Line-R 600 ..... 119.09

Tripp Lite

BC250 ..... 94.97
BC PERS 420 ..... 138.91
BC PRO 550 ..... 188.16
BC PERS 500 ..... 173.09
BC PRO 675 ..... 231.43
BC PRO 850 ..... 289.03
BC PRO 1050 ..... 327.59
BC PRO 1400 ..... 426.10

SMART UPS SERIES NEW

SMART 280 LAN 218.30
SMART 450 LAN 273.94
SMART 675 LAN 313.69
SMART 850 LAN 389.74
SMART 1050 LAN 455.07
SMART 1400 LAN 569.41
Isobar 4 OUTLET 38.95
Isobar 6 OUTLET 46.38

PCMCIA CARDS

3Com Etherlink IIIB combo 213.38
Adaptec APA1460 SCSI-2 ..... 209.69
Hayes EZJack 14.4 w.fax 169.75
Hayes EZJack V.34 w/fax 299.87
IBM Token Ring 16/4 ..... 336.57
Linksys Ethernet combo 167.56
Megahertz 14.4K data/fax 179.48
Megahertz XJack 14.4 data/fax 169.55
Megahertz XJack Gold 14.4 data/fax 198.89
Megahertz V.34 XJack data/fax 299.78
New Media Bus Toaster SCSI-2 host 197.92
New Media Wave Jammer sound card 229.48
New Media Multimedia Combo 439.80
Simple Tech 14.4K modem + voice 149.13
Simple Tech Ethernet 10BT adapter 129.16
Simple Tech SCSI adapter 145.51
Simple Tech 130MB hard drive 346.52
Simple Tech 170MB hard drive 404.60
SMC Elite Ethernet 10BT 126.13
SMC Elite Ethernet combo 173.77
Turtle Beach Audio Advantage 119.98
USR Sportster V.34 ..... 177.78
USR Sportster 14.4K 319.40
Xircom Ethernet 10BT 158.69
Xircom Ethernet combo 206.15
Xircom Ethernet+modem 10BT 319.69
Xircom Ethernet+modem combo 416.67
Xircom Token Ring 16/4 ..... 409.84

INTEL OVERDRIVE

Intel OverDrive DX2/50 ..... 125.68
Intel OverDrive DX2/66 ..... 139.79
Intel OverDrive DX4/75 ..... 149.78
Intel OverDrive DX4/100 ..... 194.62
Intel OverDrive Pentium 63MHz 285.37

MEMORY UPGRADES

simple TECHNOLOGY INCORPORATED

AST Ascentia 910N 4MB ..... CALL!
AST PowerExec 4/33SL 4MB ..... CALL!
AST PowerExec 4/33SL 16MB ..... CALL!
HP LaserJet 4L 1MB ..... CALL!
HP LaserJet 4P 4MB ..... CALL!
HP LaserJet 4 4MB ..... CALL!
HP LaserJet 4 8MB ..... CALL!
IBM ThinkPad 500 4MB ..... CALL!
IBM ThinkPad 500 8MB ..... CALL!
IBM ThinkPad 755 4MB ..... CALL!
IBM ThinkPad 755 8MB ..... CALL!
Toshiba 1900-4600 4MB ..... CALL!
Toshiba 1900-4600 8MB ..... CALL!
Toshiba 1900-4600 16MB ..... CALL!
Toshiba 4700/4800 32MB ..... CALL!
NEC Versa 4MB ..... CALL!
NEC Versa 8MB ..... CALL!

COMPUTER DISCOUNT WAREHOUSE™

FREE TECHNICAL SUPPORT FOR CDW® CUSTOMERS.

CDW® Sells for Less and Services You Better!

(800) 959-4CDW

FAX (708) 465-6800

©1995 CDW® Computer Centers, Inc. BYTE 1386

CALL FOR FREE CDW® CATALOG

Visit CDW on the Internet! http://www.cdw.com/

Byte 10/95

Circle 148 on Inquiry Card.

You'll find it in the heartland of America.

...in the hot and dusty cab of a giant combine, using a GPS and recording crop yields

You'll find it in demanding environment

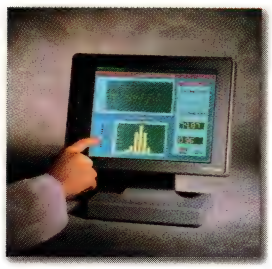
...such as hospitals supplying critical Point-Of-Car information at the touch of a finger

When faced with selecting a PC for control or data processing systems, designers usually must choose between a desktop system, notebook or an expensive single board industrial computer.

DATALUX now offers ar alternative with the essential PC system components in a series of unique packages tha both save space and ar easy to integrate.

THE DATABRICK from DATALUX

A **tough, *compact PC*** solution that offers the modularity of a desktop system and the ***small size*** of a notebook.



Stand-Alone LCD Monitors
DATALUX is in its 4th year of LCD monitor manufacture and is an industry leader. Its new LCD Monitors use brighter 10.4" diagonal Dual-Scan or TFT Color panel in a rugged, sealed, yet attractive housing with a selection of 8 wall or base mounting options. Resolution is 640 x 480. The monitors can be driven directly from a Databrick or through an ISA bus controller. No external power is required. An integrated resistive **Touch Screen** is optional with input through one of the Com Ports. Monitors may be extended to 50' from the CPU.

Keyboards
The Space-Saver keyboard is the smallest full function 100 key keyboard available. With standard left right spacing touch typing is easy yet the overall size is only 6" x 10.75".
It is available in a flat, panel mount or desktop model. The Glidepoint® pointing device is available as an option.

FAX BACK DATA SHEETS (540) 662-1675

Circle 154 on Inquiry Card.

Databrick Vertical Systems
The new DATALUX Databrick Vertical System (DVS) combines the Databrick, LCD Monitor and the Space-Saver Keyboard in a unique enclosure for Wall, Swing Arm, or Pedestal Mounting. The all aluminum housing provides compactness and security. The monitor screen tilts to accommodate the height of the user. A variety of options include bar code and mag stripe readers, speakers, or a small printer. The DVS measures 13.5" x 19.6" x 3.2".

Databrick
The Databrick is the heart of the DATALUX system. In performance and features it is more like a desktop unit, in size comparable a notebook (10.25" x 4.8" x 2"), yet more rugged and more easily mounted than either.

Specifications:
486DX2/66 or DX4/100 CPU
2-64 Meg Standard SIMM DRAM
Internal or External FDD
Internal HDD to 540 Meg
SVGA CRT and LCD Video Ports w/1Meg
2 Serial, 1 Extended Parallel Port

Options:
2 slot PCMCIA
10Bt Ethernet LAN
Com Ports 3 & 4
DC-DC Power converter

DVS shown here on Rolling Stand

DATALUX

Datalux Corporation
155 Aviation Drive
Winchester, Virginia 22602
Phone: (540) 662-1500
Fax: (540) 662-1682
Toll Free: 1-800-328-2589
(1-800-DATALUX)

Datalux International, LTD
Euro House Curtis Road,
11 Old Water Yard
Dorking, Surrey
UNITED KINGDOM RH41EJ
Phone: 44+(1)306-876718
Fax: 44+(1)306-876742

Discover the Key to Consolidated Control!

COME SEE US AT
Networld+Interop
in Atlanta, GA, Sept 27–29
Booth #5166

AutoBoot Commander
Personal Commander

The industry standard AutoBoot Commander allows you to monitor and control up to 96 PCs or file servers with just one keyboard, monitor and mouse. For desktop control of smaller installations, give our Personal Commander a try!

Slimline Commander
Magnum Commander

The most streamlined members of the AutoBoot family, these Commanders are designed specifically for all your rack mount applications. Choose the 1.75" (1U) Slimline for 19" racks, or the 3.5" (2U) Magnum for 19, 23, or 24" racks.

AutoBoot Commander
4xP/1xP

The most advanced AutoBoot products yet, the 4xP and 1xP add multiuser, multiplatform and multimedia capabilities to the Commander world. Control PC, Mac and Sun computers from one location! Use the 4xP for larger installations; try the 1xP for desktop control of smaller configurations.

Cybex Corporation
4912 Research Drive Huntsville, AL 35805 USA
(205) 430-4000 (205) 430-4030 fax
http://www.cybex.com/

An Inc. 500 Company

CYBEX™

PC is a registered trademark of International Business Machines Corporation. Mac is a registered trademark of Apple Computer, Inc. Sun is a registered trademark of Sun Microsystems. Cybex, AutoBoot, Commander, Slimline, 4xP and 1xP are trademarks of Cybex Corporation.

Circle 150 on Inquiry Card (RESELLERS: 151).

PCs COMPLEAT

Call for a FREE PRODUCT GUIDE

800-298-4727

THE BEST BR DELIVERY

TOSHIBA

Pentium 75 Built-in 4X CD-ROM

Satellite Pro 400

- Built-in 4X CD-ROM Drive (Swap floppy and CD-ROM) (Active model only-optional on Dual Scan)
- Pentium 75MHz Processor
- Built-in 16-bit sound, microphone, speaker & MIDI
- 10.4" Active & Dual Scan
- Built-in AC adapter - small, sleek design & reduced weight
- Integrated Accupoint - small, accurate & easy to use
- Lithium Ion battery technology
- Built-in infrared for no hassle printer connections

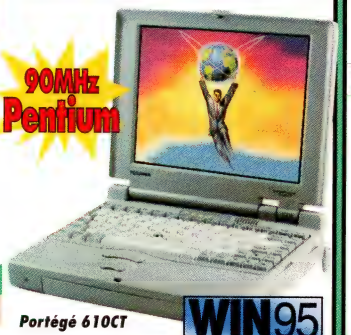
Pro 400

Processor	Screen	HD	Price
Pentium 75MHz	10.4" Dual Scan	772MB	$3539
Pentium 75MHz	10.4" Active	772MB	4359

Portégé 610CT

90MHz Pentium

- Pentium 90MHz Processor
- 9.5" True Color display for optimum color
- Bi Audio speakers/microphone, SoundBlaster ProCompatible
- Lithium Ion battery technology
- Accupoint stick for easy control



Portégé 610CT

Processor	Screen	HD	Price
Pentium 90MHz	9.5" True Color	720MB	$4359

Satellite T2110/T2130

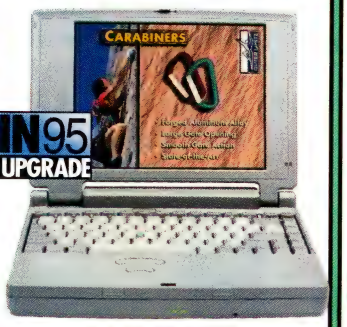
T2130

- 10.4" Dual Scan & Active
- Built-in AC adapter - small, sleek design & reduced weight
- Integrated Accupoint - small, accurate & easy to use

Processor	Screen	HD	Price
486DX4/75	10.4" Dual Scan	330MB	$1979
486DX4/75	10.4" Dual Scan	500MB	2459
486DX4/75	10.4" Active	500MB	3059

Satellite T2100

- Built-in AC Adapter for easy connections
- 4MB/28MB memory
- 2 Type II or 1 Type III PCMCIA slots
- **FREE** Windows 95 Upgrade



T2110

Processor	Screen	HD	Price
486DX2/50	9.5" Mono	250MB	$1199
486DX2/50	8.4" Active	330MB	2399

© PCs Compleat. All prices subject to change and do not include shipping. All products or brand names are trademarks of their respective companies. PCs Compleat, 34 St. Martin Drive, Marlborough, MA 01752. Phone (508) 624-6400. Not responsible for typographical errors.

NEC

Versa 2000

- Lithium Ion battery technology
- VersaGlide touch-pad pointer – simple & accurate
- Built-in, upgradable 14.4 fax/modem (active models only)
- LOADS of **FREE** software preinstalled

Processor	Screen	HD	Price
486DX4/75	10.4" Dual Scan	350MB	$1999
486DX4/75	9.5" Active	350MB	2299*
486DX4/75	9.5" Active	350MB	2599
486DX4/75	9.5" Active	540MB	2799

*14.4 fax/modem not built-in

Additional NEC Products

Chassis	Processor	HD	Price
NEC Ready Multimedia			
Minitower 5010	486DX4/100	540MB	$1499
Minitower 7020	Pentium 75	850MB	1799
Minitower 9010	Pentium 90	850MB	2099
Minitower 9510	Pentium 90	1.2GB	2499
Minitower 9520	Pentium 100	1.2GB	2799

Monitors priced separately

NEC Versa 4000

- Built-in CD-ROM drive! (Standard on some models, optional on others)
- Pentium 75 and Pentium 90 processors
- 256KB Level 2 Cache to optimize performance
- Unbelievable displays – 65K color Dual Scan, 16.8 million color Active (High resolution Active Matr displays available – 800x600 res.)
- Built-in 16-bit sound, microphone, MIDI and 2 built-in speakers
- Multimedia docking station with outstanding Altec Lansing 4 speaker array

Processor	Screen	HD	Price
Pentium 75	10.4" Dual Scan	540MB	$3499
Pentium 75	10.4" Dual Scan	540MB	3799*
Pentium 75	10.1" Active	540MB	4199
Pentium 90	10.1" Active	810MB	4899*
Pentium 90	10.4" High Res.	810MB	5099

* Features built-in CD-ROM drive standard

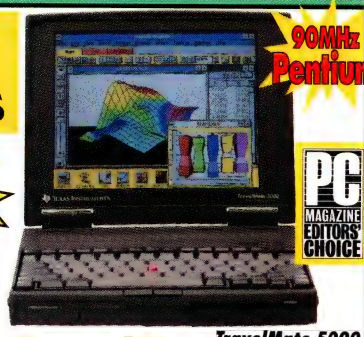
TEXAS INSTRUMENTS

Extensa 450

Extensa 450

- 10.4" Dual Scan & 9.5" Active display
- GlidePad pointing device
- Advanced battery pro
- Built-in infrared for no hassle printer connections

Processor	Screen	HD	Price
486DX4/75	10.4" Dual Scan	340MB	$1799
486DX4/75	9.5" Active	340MB	2399



TravelMate 5000

TravelMate 5000/5100

- 75MHz or 90MHz Pentium with PCI Bus to optimize Pentium processor performance
- 10.4" Active Matrix display with 2MB Video RAM
- 10.5" Dual Scan display with 2MB Video RAM
- 65K colors on notebook display
- 16-bit Sound Card, Speaker, Microphone & MIDI
- Upgradable hard drive - easily add more storage
- Built-In Dual Lithium Ion batteries
- Built-in infrared for no hassle printer connections

Processor	Screen	HD	Price
Pentium 75	10.4" Dual Scan	500MB	$3799*
Pentium 75	10.4" Active	772MB	4499*
Pentium 90	10.4" Active	1.2GB	5299

*Includes $100 instant rebate through 9/30/95

ONLY at PCs COMPLEAT ✓Lowest Price Guarantee ✓30-Day Money Back Guarantee ✓Free Tech Support ✓Free Software Installation ✓Free Configuration

ANDS, PRICE, & SERVICE

CALL for Guaranteed Lowest Price!

PCs COMPLEAT

800-298-4727

AST COMPUTER

Authorized System Reseller

Ask about NEW Ascentia 950N Pentium 90MHz

Advantage Adventure

Additional Products from AST

Processor	Screen	HD	Price
Ascentia 950N (WIN95 INSTALLED)			
Pentium 75	10.4" Dual Scan	500MB	$ 3299
Pentium 75	10.4" Dual Scan	800MB	3589
Pentium 75	10.4" Dual Scan	1.2GB	4059
Pentium 75	10.4" Active	800MB	4719
Pentium 75	10.4" Active	1.2GB	5189
Ascentia 910N			
486DX4/75	10.3" Dual Scan	510MB	$2469
486DX4/75	10.3" Dual Scan	700MB	2649
486DX4/75	10.4" Active	510MB	3119
486DX4/75	10.4" Active	700MB	3199

AST, AST logo are trademarks of AST Research, Inc. All rights reserved.

Advantage Adventure Multimedia (4X CD-ROM)

NEW for Windows 95

- Quad Speed CD-ROM Drive
- Advanced Telephony – 14.4 or 28.8 fax/modem, telephone answering system, and speaker phone (differs by model, call for details)
- Loads of **FREE** software preinstalled
- Windows 95 keyboard for increased productivity
- AST Works II navigation software – featuring "SPOT"

Chassis	Processor	HD	Price
Desktop (612)	Pentium 75	850MB	CALL
Minitower (812)	Pentium 100	1.2GB	CALL
Minitower (814)	Pentium 100	1.2GB	CALL*
Minitower (818)	Pentium 133	1.6GB	CALL*

Monitors priced separately **16MB RAM standard*

IBM®

Authorized Personal Computer Dealer

Call about IBM® desktop & server PCs

ThinkPad® 701

Additional IBM® Notebooks

Processor	Screen	HD	Price
ThinkPad®755			
486DX4/100	10.4" Active	540MB	$4649
486DX4/100	10.4" Active	810MB	5099
486DX4/100	10.4" Active	540MB	5649*
486DX4/100	10.4" Active	810MB	6099*
Pentium 75	10.4" Active	540MB	4749+
Pentium 75	10.4" Active	810MB	5199+
Pentium 75	10.4" Active	540MB	5799
Pentium 75	10.4" Active	810MB	6249
486DX4/100	10.4" Active LCD	540MB	6099
486DX4/100	10.4" Active LCD	540MB	7099*
486DX4/100	10.4" Active LCD	810MB	7549*

**Features Built-In CD-ROM drive*
+ Does not include built-in audio, telephony & modem

ThinkPad® 701

- Amazing pop-up, full-sized keyboard w/ jigsaw design
- 10.4" Active & Dual Scan
- Only 4.5 lbs. in subnotebook form factor
- 14.4 fax/modem, speaker phone, answering machine & voice mail
- Built-in 16-bit sound, microphone, speaker & MIDI
- Built-in infrared for no hassle printer connections
- 20 **FREE** software titles preinstalled

NEW LOW PRICES!

Processor	Screen	HD	Price
486DX2/50	10.4" Active	360MB	$2999
486DX2/50	10.4" Active	540MB	3299
486DX4/75	10.4" Dual Scan	360MB	3149
486DX4/75	10.4" Dual Scan	540MB	3449
486DX4/75	10.4" Active	360MB	3699
486DX4/75	10.4" Active	540MB	3999

COMPAQ

Contura 410
Product differs slightly from photo.

Contura 420/430

- 10.4" Active & Dual Scan
- Fast 486DX4/75 or 486DX4/100 processors
- Optical trackball – smoother & more reliable
- High capacity drives – up to 720MB
- Compaq, 3-year worldwide warranty

Processor	Screen	HD	Price
486DX4/75	10.4" Dual Scan	420MB	$2459
486DX4/75	10.4" Active	420MB	3029
486DX4/100	10.4" Dual Scan	720MB	2839
486DX4/100	10.4" Active	720MB	3499

LTE Elite

LTE Elite

- 10.4" Active Matrix display
- Fast 486DX4/75 processor
- Built-in AC adapter - small, sleek design & reduced weight
- Upgradable hard drive - easily add more storage

Processor	Screen	HD	Price
486DX4/75	9.5" Dual Scan	340MB	$2739
486DX4/75	9.5" Dual Scan	510MB	2999
486DX4/75	10.4" Active	510MB	4159
486DX4/75	10.4" Active	810MB	4539

Byte 10/95

HEWLETT® PACKARD

90MHz Pentium With PCI Bus

HP OmniBook 5000 Notebook PC

HP OmniBook 5000

- Pentium 90MHz with 32-bit PCI Local bus
- Up to 1.2GB drives available for high capacity storage
- High resolution – 800x600 resolution on notebook display
- Built-in 16-bit sound, microphone & speaker

Processor	Screen	HD	Price
Pentium 90	10.4" Active	1.2GB	$5579
Pentium 90	10.4" Active	1.2GB	6239*

**16MB RAM standard*

WIN95 INSTALLED

HP OmniBook 600

- Weighs as little as 3.8 lbs.
- Built-in infrared for no hassle printer connections
- Instant "ON" ready-to-work state – lasts for months on a charge
- Built-in 16-bit sound, microphone & speaker (486DX4/75, 9.5" Active Model only)

NEW LOW PRICES!

Processor	Screen	HD	Price
486DX2/50	8.5" Dual Scan	260MB	$2169
486DX4/75	8.5" Dual Scan	260MB	2599
486DX4/75	9.5" Active	260MB	3099

HP LaserJet Printers

HP LaserJet 5P printer (IBM, 6ppm, 600dpi)	$879.99
HP LaserJet 5MP printer (IBM&MAC, 6ppm, 600dpi)	1039.99
HP LaserJet 4L printer (IBM, 4ppm, 300dpi)	499.99

HP InkJet Printers

HP DeskJet 320 printer (portable)	$299.99
HP DeskJet 320 printer w/feeder	359.99
HP DeskJet 600 printer	289.99
HP DeskJet 600C printer	299.00
HP DeskJet 660C printer	389.99
HP DeskJet 855C printer	549.00
HP DeskJet 1200C printer	979.99
HP DeskJet 1600C printer	1349.99

Home Office Products

HP OfficeJet	$599.99
HP FAX-700	549.99

More Brand Names, peripherals and software available. If you don't see it, CALL!

International 508-624-6400
Internet: sales@pcscompleat.com
Open 24 Hours weekdays. 8am–8pm weekends and holidays.

800-298-4727

Circle 176 on Inquiry Card.

Rock 'n' Roll is big business with a need for powerful software solutions.

DATAFLEX® MEANS BUSINESS

When you choose the DataFlex application development system, you can count on delivering powerful solutions. DataFlex's greatest strength is in the language, a 4GL strong enough to sustain anything you can build on it. Powerful enough to take you far beyond the point at which most other products leave you stranded.

Over 350,000 installations and 2,000,000 users in 40 countries make DataFlex a proven solution for a wide range of business applications for companies like Mercedes-Benz, Coca-Cola, and the Rock and Roll Hall of Fame.

"DataFlex's greatest strength is in the language itself. I like knowing my customers, from the Pittsburgh Symphony to the Rock and Roll Hall of Fame, can depend on their DataFlex-based applications to manage their very hectic schedules. I, as the developer, can focus on the business requirements of the application, rather than the underlying language capabilities and systems."

Randy Slapnicka
Event Software Corp.

DataFlex means business. We speak your language because we want you to speak ours. Call us today for a free information kit.

In the United States, Phone 1-800-451-3539 For Sales Information

Country	Telephone	Fax	Country	Telephone	Fax
Australia	1-800-65-3545	(09)481-1874	Mexico	(525)631-4663	(525)631-4538
	1-800-63-3539	(03)888-9950	Netherlands	074-55 56 09	074-50 34 66
Brazil	(011)872-9266	(011)653-899	Norway	(22) 55 99 66	(22) 56 28 25
Canada	416-226-2181	416-226-4341	Poland	(42) 30 76 43	(42) 30 76 46
Denmark	36 72 46 46	36 72 46 47	Spain	(1)372-95-17	(1)372-81-56
Germany	06172-9568-0	06172-9568-12	Sweden	(0)300-19530	(0)300-70910
Greece	(1)6517945	(1)6536891	Thailand	(02)276-2559	(02)275-9156
Italy	(0184)231.606	(0184)231.243	Trinidad	(809)628-9330	(809)628-9259
Japan	(3)-3296-7324	(3)-3296-7329	United Kingdom	0181-742-8055	0181-742-7843
Malta	356-241246	356-230631		0181-866-4400	0181-866-3725

DATA ACCESS
CORPORATION

CompuServe: GO DACCESS - Internet (WWW): http://www.daccess.com
Phone 305 238-0012

HARD DISK EXCHANGE

BUY, SELL OR UPGRADE YOUR HARD DISK & PC

(714) 505-3157

Int'l Orders / Tech Assistance Inquiries

UNIVERSITY, SCHOOLS, GOVERNMENT & CORPORATE P.O.'S WELCOME

HARD DISK PRICES SLASHED

IDE

40MB	$59
65MB	$69 ✓✓
120MB	$99
210MB	$129

Maxtor, Seagate Available

ESDI

Micropolis 1355	$99 ✓
Micropolis 1558	$199
XT-4380E	$129
XT-8760E	$399 ✓
ST-4766E	$499

Conner & Maxtor Available

LOOKING FOR SOMETHING SPECIAL? ASK US!

MFM/RLL

ST-225 20MB	$39 ✓
ST-251 40MB	$79
ST-151 40MB	$129
ST-4096 80MB	$109 ✓
Priam-185 71MB	$89 ✓
ST-238R 32MB	$69
ST-277R 65MB	$99
XT-2190 145MB	$299
XT-1140 120MB	$279

SCSI

ST-225N	$49
ST-277N	$89
ST-4380N	$129 ✓

COMPAQ

CP4021	$149
CP4041	$209
CP2121	$179

Quantum & WD Available

FOR "HARD-TO-FIND" HARD DISKS CALL JIM OR MANDY

MOTHERBOARDS

CPU INCLUDED

386 SX/40	$69
486 SLC-33	$69
486 DX-33	$129
486 DX2/66	$139
486DX2/80	$149
Pentium 90	$399
Pentium 100	$599

SPECIAL ✓✓✓

DX4-100MB with 256 Cache, Fan & CPU $229

NEW HARD DRIVES

IDE - 3.5"

540MB	$169
850MB	$199
1.26GB	$249

SCSI-II

540MB	$229
1.08GB	$444
2.10GB	$899
4.00GB	$1499

WIDE SCSI-II

1.08GB	$579
2.10GB	$1099
4.10GB	$1599

2.5" Notebook Drives

40MB	$79
65MB	$89
120MB	$159
250MB	$199
340MB	$299
540MB	$399
810MB	$599

SPECIAL

240MB Maxtor	$199
65MB	$69

Math Co.

387SX	$29
387DX	$29

CPU

486DX-33	$69
486DX2-66	$79
486DX2-80	$89
486DX4-100	$99
Pentium 90	$329
Pentium 100	$429
120/133	CALL

DATA RECOVERY

By Experts

UNIX, DOS, MAC, OS/2, NOVELL

Almost 100% Success

CALL FOR ESTIMATE

No Recovery - No Charge

Ask for Jim, Matt or Mandy

MULTI-MEDIA

2 Speed CD-ROM, Sound Blaster Card, Speakers, Audio Cable $119

CD-ROM - 4 Speed with Sound Blaster, OEM Card, Titles $299

MEMORY

256x9	$11.99
1x3 - 70	$36.99
4x3 - 70	$129.99
4MB - 72 Pins	$149.99
8MB - 72 Pins	$299.99
16MB - 72 Pins	$499.99
32MB - 72 Pins	CALL

CALL FOR CURRENT PRICES

Tape Back-Up Special

Trakker 250MB **$199** Limited Quantities Available

DEMO PC COMPUTERS

486DX2/66

4MB, MiniTower, DX2/66 CPU w/Cooling Fan, 256K VGA Card, 540MB HD 101 Keyboard, 2 speed CD-ROM, speakers, 16 bit sound card, and cables

$699

486DX/33

2MB RAM, IDE I/O MiniTower, 1.44 FDD 200MB HD, 101 Keyboard

$379

486DX4/100

4MB, 256K Cache, MiniTower, DX4/100 CPU w/Cooling Fan, 1.2GB HDD, 2S/1P Ports 256K VGA Card, 101 Keyboard

$739

On-Site Warranty Option Available on All Systems... Ask About It!

PENTIUM 100 SPECIAL

MiniTower, Pentium 100 CPU w/Cooling Fan, 8MB RAM, PCI IDE Controller, 1.44 FDD 1.2GB, 2S/1P Port, 1MB Super VGA,101 Keyboard

SUPER PRICE

$1199

586-90

Complete System

Pentium 90 Compatible, 4MB RAM, 540 HD, MiniTower IDE/IO, 2S, 1P, 1.44 FDD 101 Keyboard, 1MB SVGA card, .28dp 14" SVGA Monitor

$999

Halleluiah!

DX4/100

Hi Tech Special

MiniTower, Motherboard CPU w/Cooling Fan, 256K Cache, 200 Watt Power Supply

$299

Talk to Our System Specialists Jim, Matt or Mandy for your Custom-Made Systems

CONTROLLERS, ETC.

MFM 8/16	$29
IDE 16 Bit	$19
IDE 8 Bit	$49
SCSI 8 Bit	$39
SCSI 16 Bit	$89
ESDI 16 Bit (300MB)	$49
ESDI 16 Bit (1GB)	$149
Adaptec 1542	$219
Adaptec 2940	$239
IDE VLB	$29

SRAM/CACHE MEMORY

32K x 8, 64K x 8 & 128K x 8 ..... *CALL!*

MONITOR - .28DP

14" - 1024x768

Color **$179** SVGA

DEMO NOTEBOOK $399

CREDIT CARD ALERT!

Beware... Fraudulent users are caught by our security system.

– 27 convictions pending.

WE BUY

MEMORY SIMMS & HARD DISKS

Call Perry, Mandy or Matt

(714) 505-3157

IBM PS/1, PS/2 CORNER

Contact Jim or Mandy

SUPER SPECIAL PS/2 HDD

IBM 665, 667, 669 - All Models

Only $59 - Limited Qty.

THINKPAD DRIVES

Model 360/750/755

340MB	$375
540MB	$475
810MB	$599

WD -380S	$69
ST-177i	$99
WD - 3158	$149

Ask for Think Pad Memory & Value Point Memory... ... We Carry PS/1 & PS/2 Keyboards & Floppies

For Customer Service Call between 11:00 a.m. to 3:00 p.m. PST at (714) 505-3831

800-801-9400

Call Toll Free for Orders Only

VISA MasterCard

ASHTEK INC.

2600-B WALNUT AVE., TUSTIN, CA 92680

THESE ARE CASH PRICES & SUBJECT TO CHANGE WITHOUT NOTICE.

SHIPPING BY FEDERAL EXPRESS AND U.P.S. C.O.D. - *(There is a 20% re-stocking charge.)*

714-505-2693

FOR FAX ORDERS

American Express Card DISCOVER Financial Services Card

Circle 180 on Inquiry Card.

When disaster strikes your computer, be prepared with advanced technology from MICRO 2000...

ALL COMPUTER EQUIPMENT will eventually fail. It may take years before your hard drive crashes. It may be months before you have any serious data loss, problems with your memory or experience chip failure. Then again, it could be today!

At MICRO 2000 we are constantly thinking ahead to provide you with the products you'll need to protect yourself from hours of frustration and downtime. Our expanding line of products can assist you to recover data from a crashed disk when all the others have failed.

We can help you diagnose what's wrong with your PCs in a flash, on-site or remotely—without a modem!

Tech Support you can count on in the crunch...

Good products are one thing, but how about someone to walk you through the tough stuff? Even though a large percentage of our clients are professional technicians and power users, we regularly receive calls from beginning users who need help getting started. After all, these are tomorrow's power users and technicians.

Advanced technology based on what you need...

You can help us to serve you. If you use any of our products, please let us know what you like about them, or what improvements we could make. We try to make each new version fulfill as many needs and wishes as possible, as your business and success are important to us. Give us a call or write to us with any comments.

MICRO 2000

Call 1-800-864-8008

THIS IS A MUST-HAVE TOOL for PC Service Technicians everywhere. Supply your customers with this inexpensive software and let MICRO-SCOPE CLIENT diagnose what's wrong with their PCs without leaving your office!

When your customer calls you with a service problem, simply have him boot his PC with the **Micro-Scope CLIENT** floppy disk in drive A and select either the Quick Test or the Extensive Test. Then just look up the resulting error codes in the CLIENT manual and you'll know exactly what's wrong and be able to bring the correct replacement chips, drives, cables, etc. CLIENT also reports the exact system configuration so you can insure compatibility. Saves time and money!

MICRO-SCOPE CENSUS LETS YOU keep track of hundreds or even thousands of computers and know each one's exact hardware and system configuration at a glance. Many technicians and MIS Directors use this software tool to save hours of downtime in companies with multiple computers.

Simply load the supplied disk into each computer on site (up to 100 PCs recordable on each disk). **CENSUS** automatically records complete system information and assigns each PC a unique ID number. The data can now be downloaded from the disk into any database program so it's ready to retrieve at a moments notice. For even greater productivity and speed, use CENSUS in combination with MICRO-SCOPE CLIENT to remotely diagnose each PC and arrive with the exact parts required, fully compatible. You'll be in and out in a flash with a greater profit margin.

QUITE OFTEN THINGS AREN'T what they seem. The rated speed and efficiency of a computer can be misleading—and sometimes absolutely false. You should know exactly what you're getting for your money!

Imagine walking into a computer store, pulling out your **COMPUTER CONSULTANT** diskette, placing it into the A drive of a computer and having detailed, 100% accurate information about the PC. In a matter of minutes you could test every PC in the store, and knowing the exact configuration of each, determine which one was best for your needs without all the sales hype. That's what COMPUTER CONSULTANT can do for you.

AT LAST—EXTENSIVE AND FOOLPROOF data recovery for everyone! The only comparable service to 911-RECOVER is a professional data recovery company, which could take several weeks and cost you hundreds or thousands of dollars.

Avoid the downtime and worry by using **911-RECOVER** right in your own office. 911-RECOVER reads right down to the bit level even if the directories and File Allocation Tables are damaged. It can recover data that has been damaged by other "recovery software." Does not need DOS intact to function. If the data is physically on the drive, it *can* be recovered.

What to do when your PC coughs, wheezes and/or dies...

the UNIVERSAL DIAGNOSTICS TOOLKIT™

Works with any PC & Operating System!

Call Now for Information on Special Pricing:

1-800-864-8008

or Fax (818) 547-0397

VISA MasterCard AMERICAN EXPRESS DISCOVER

1100 East Broadway, Suite 301, Glendale, California
Phone 818/547-0125 • Fax 818/547-0397
International Orders please call:
Micro 2000 Australia: 61-42-574144
Micro 2000 Europe (UK): 44-462-483-483

Micro-Scope 6.0
UNIVERSAL DIAGNOSTIC SOFTWARE

New Version Release

Fully O/S independent diagnostic software...

Call for upgrade pricing & complete new features list!

MICRO-SCOPE Universal Computer Diagnostics was developed to satisfy the expanding need for accurate system diagnosis in the rapidly growing desktop computer market. Patterned after super-mini and mainframe diagnostic routines, **MICRO-SCOPE** runs independently of any standard operating system, and is therefore at home on any machine in the Intel world. Speed, ease-of-use, and razor sharp accuracy are a few of the advantages that arise from this system independence. Jerry Pournelle awarded MICRO-SCOPE & POST-PROBE the User's Choice Award in the May 1994 issue of Byte Magazine: **"You name it, this tests it. If you maintain PCs you'll love it."**

◆ **LOW-LEVEL FORMAT**—Performs Low-level format on all drive types including IDE drives. This function cannot hurt IDE drives. ◆ **USE CONTROLLER BIOS**—Program will access BIOS format built into any hard disk controller—even Controllers yet to be invented. ◆ **O/S INDEPENDENT**—Does not rely on O/S for diagnostics. Talks to PC on hardware level. All tests are full function regardless of O/S (i.e. Novell, UNIX, OS/2). ◆ **TRUE HARDWARE DIAGNOSTICS**—Accurate testing of CPU, IRQ's, DMA's, memory, hard drives, floppy drives, video cards, etc. ◆ **BATCH CONTROL**—All tests, even destructive, may be selected for testing. ◆ **ERROR LOGGING**—Automatically inputs errors during testing to an error log. ◆ **AUTOMAPPING**—Automatically bad sector maps errors found on hard disks. ◆ **IRQ DISPLAY**—Show bits enabled in IRQ chip for finding cards that are software driven. (Network, Tape Backup, etc.) ◆ **IRQ CHECK**—Talks directly to hardware and shows I/O address and IRQ of devices that respond. ◆ **MEMORY EXAMINE**—Displays any physical bit of memory under 1 Meg. Very useful for determining memory conflicts. Very useful for determining available memory space. ◆ **SECTOR EDITOR**—Allows the editing of any sector of floppy or hard disk media (even track 0). ◆ **AND MUCH MORE...**We don't have enough space here for everything this software can do!

Post◆Probe™
First Ever Universal P.O.S.T. Card for All PCs!

The only Power-On Self-Test card you need to debug any "dead" PC...

"This is the only card that will function in every system on the market. The documentation is extensive, and not only covers the expected POST Codes for different BIOS versions, but also includes a detailed reference to the bus signals monitored by the card." —**Scott Mueller** from his globally recognized book, ***'Upgrading & Repairing PCs, Second Edition'***

◆ Includes pads for voltmeter to attach for actual voltage testing under load. ◆ 4 LEDs monitor +5vdc -5vdc +12vdc -12vdc. ◆ Monitors Hi & Lo clock and OSC cycles to distinguish between clock chip or crystal failure. ◆ Monitors I/O Write and I/O Read to distinguish between write and read errors. ◆ Monitors memory write/ read to distinguish between address line failures and memory chip failures. ◆ Monitors ALE for proper CPU/DMA operation. ◆ Monitors Reset to determine if reset is occurring during POST, indicating short. ◆ Monitors progress of POST *without* POST codes. ◆ Reads POST codes from any IBM or compatible that emits POST codes. ISA/EISA/MCA. ◆ Compatible with Micro Channel computers. ◆ Dip switch allows easy selection of I/O ports to read. ◆ Includes tri-state **LOGIC PROBE** to determine actual chip failures. ◆ Manual includes chip layouts and detailed POST procedures for all major BIOS's. ◆ **AND MUCH MORE...**call for more details.

Award Winning

1993 BYTE POURNELLE'S USER'S CHOICE AWARD

PCUPGRADE UTILITY OF THE MONTH

SERVICE NEWS PRODUCT OF THE MONTH

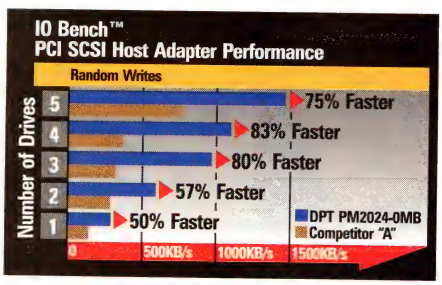
Govt. Serv. #: GS-00K-94AGS-5396

MICRO 2000

Circle 250 on Inquiry Card (RESELLERS: 251).

Lightning does strike twice!

Combine DPT's PCI SCSI performance with the power of your Pentium, and watch your system sizzle. Of course you can install your DPT PCI SCSI adapters with confidence because they are fully compatible with the latest version of the PCI specification, and we have tested compatibility with thousands of products and operating systems.



For even faster performance, you can easily add hardware caching and RAID support with optional plug-on modules.

Installation couldn't be easier: all DPT PCI SCSI Adapters are Plug-and-Play ready and come complete with Storage Manager,™ DPT's award-winning setup and maintenance software.

Order a DPT PCI SCSI Adapter today and find out for yourself just how fast lightning really is.

1-800-322-4378

DPT
Distributed Processing Technology
140 Candace Drive, Maitland, FL 32751

Circle 155 on Inquiry Card.

Back up!

Before all your hard work goes down the drain.

Why risk losing your data when it's so easy to **BACK UP** with a **backpack 800T** tape drive?

The **backpack 800T** stores up to 800MB of data on a single Travan™ TR-1 tape.

No slots? No problem. There are no cards to install.

backpack® 800T

MicroSolutions

Call Toll Free - 800.295.1214

Plug the **backpack 800T** into your computer's printer port; plug your printer into the port on the back of the tape drive (Windows™ and DOS backup software is included free).

Join the **backpack** drive family today... Easy plug and play tape back up, CD-ROM, hard disk and diskette drives.

TRAVAN™ TECHNOLOGY

Travan is a trademark of 3M.

132 W. Lincoln Hwy. DeKalb, Illinois 60115 • Telephone 815.756.3411 • FAX 815.756.2928

Circle 158 on Inquiry Card (RESELLERS: 159).

FUTURE MICRO

World Leader in PC Upgrades

100% COMPATIBILITY GUARANTEED

Call the Upgrade Experts

We Guarantee the Right Upgrade for Your PC or Your Money Back!

MONTHLY SPECIALS

Super P55CWA/GA-586AT
w90/100/120/133Mhz $595/629/CALL

Quad Spin 4X CD/Sound Blaster 16
and Speakers..... $259

560MB/1GB-IDE HDD $179/299

AHA 2940 SCSI only $200 w/Pentium Boards

GA486VF/VS
30 or 72 Pin Version w/Fan
w/486DX4-100 ..... $259
w/486DX2-80 ..... $225
w/486DX2-66 ..... $209
With VLB IDE-IO &VLB SVGA 1MB add..... $100
486DX4-100 OVERDRIVE ODP/ODPR $219

CALL FOR INFO ON DAILY SPECIALS AND BLOWOUTS

Pentium Mother Board Upgrades

Intel Advanced/ZP
3 PCI, 4 ISA, 256k Cache
PCI Enhanced IDE, FDD, 2 Ser, 1 Par, Built In
Intel Flash BIOS, Intel Triton Chipset
90/100/120Mhz $267
Call for Info on the Latest Intel Motherboards

GA-586AT PCI-ISA
3 PCI, 4 ISA, 2 IDE Channels, FDD
2 16550 Ser, 1 ECP/EPP Par
256k-512k Cache, Standard or EDO Ram
Award Flash BIOS, Intel Triton Chipset
75-150Mhz $259

Super P55CWA-PCI w/Intel VRM Universal Motherboard Architecture
4 PCI, 4 ISA Slots, 2 PCI IDE Controllers
Intel Triton Chipset, AMI Flash BIOS
75-133Mhz, Supports EDO Memory
256 to 512k Cache $299
With Adaptec 2940 PCI SCSI add $200

Super P55CM-PCI w/Intel VRM
4 PCI, 4 ISA Slots, 2 PCI IDE Controllers
2 16550 Ser, 1 EPP Par, FDD Support
Intel Triton Chipset, AMI Flash BIOS
75-133Mhz, PS/2 Mouse Port
Pipeline Burst Cache, 256 to 512k Cache . $CALL
With Adaptec 2940 PCI SCSI add $200

GA-586ID PCI/EISA DUAL PROCESSOR
3 PCI, 5 EISA, 1 or 2 Pentium CPU's
Exp to 196MB, 512k Cache
AwardFlash BIOS, IntelChipset 90/100Mhz$550

P54 PCI
4 PCI, 4ISA 256k Cache Exp. to 512k
AMI BIOS, SIS Chipset
90/100Mhz $139

486 MOTHERBOARDS

GA-486VF/VS
Uses [8] 30 Pin SIMMs (VF) or [4] 72 Pin (VS)
3 VL Slots, 7 total, 256k Cache, Exp. to 512k
Award BIOS, SIS Chipset, 3.3&5 Volt
Deep Green, Accepts all 486 Chips & P24T
$125 w/512k $205
Now Available with 8-30 & 2-72 pin sockets!

GA-486AM PCI
3 PCI, 4 ISA
Built in PCI IDE , FDD & Hi-Speed I/O
256k Cache, Exp. to 512k
Award BIOS, UMC Chipset, Deep Green
3.3/5 Volt Switchable
Accepts all 486 Chips & P24T $165

BAREBONES

Super P55CM Bare Bones
Mid Tower Case w/Digital Display, 7 Bays
2 PCI IDE, 2 Ser, 1 Par, 1 Game
Trident PCI SVGA 1MB, 256k Cache
Pentium 90/100/120 ..... $759/877/Call
w/1.44 Floppy add $35
THE ULTIMATE UPGRADE!!!

GA-486VF/VS Bare Bones
Mini Tower Case w/Digital Display, 5 Bays
VLB IDE-IO, 2 Ser, 1 Par, 1 Game
Trident VLB SVGA 1MB, 256k Cache
486DX2-66/100 ..... $349/399
w/1.44 Floppy add $35 ..... PCI add $50
Call for Custom Bundles

CPU CHIPS

CALL FOR LATEST PRICING

Intel
Pentium 120/133/150 ..... $599/795/CALL
Pentium 90/100 ..... $299/359
Pentium 60/66/75 ..... 199/199/247
P24T(Pentium Overdrive) 63/83Mhz ..... CALL
486DX4-75/100 ..... $169/199
486DX2-66 ..... $119
486DX2-50 ..... $105
486DX-50 ..... $179
486DX-33 ..... $67
486SX-25/33 ..... $35/45
OverDrive ODP/ODPR ..... CALL

AMD/Cyrix
486DX4-100/120 ..... $119/CALL
486DX2-80 ..... $99
486DX2-66 ..... $89
486DX2-50 ..... CALL

Cyrix 386 to 486 Upgrades
486DRX2-25/50 ..... $199
486DRX2-33/66 ..... $250
486SRX2-25/50 ..... $199
Call for Latest CPU Pricing/Info/Specials!

MEMORY

CALL FOR LATEST PRICING

EDO RAM ..... CALL

72 Pin SIMMs
1 X 36 60/70/80ns (4mb) $175/159/149
1 X 32 60/70/80ns (4mb) $157/149/142
2 X 36 60/70/80ns (8mb) $345/325/319
2 X 32 60/70/80ns (8mb) $325/299/299
4 X 36 60/70ns (16mb) $545/529
4 X 32 60/70ns (16mb) $495/479
8 X 36 60/70ns (32mb) $1130/1050
8 X 32 60/70ns (32mb) $1080/950

30 Pin SIMMs
1 X 3 60/70/80ns (1mb) $45/40/39
1 X 9 60/70/80ns (1mb) $45/42/39
4 X 3 60/70ns (4mb) $135/130
4 X 9 60/70/80ns (4mb) $149/142/138

DRAM & VRAM
256k X 4 70/80ns, 1 X 1 70/80ns $6
256k X 4 70/80ns 28 Pin VRAM ZIP..... $11
256k X 16 70ns ZIP/SOJ ..... CALL

Cache
32k X 8 15/20/25ns $8/7/6
128k X 8 15/20/25ns Slim/Wide $36/34/30

VIDEO

Trident PCI/VLB/ISA 1MB $79
Cirrus Logic 5428 PCI/VLB 1/2MB.... $79/$136
S3 32 Bit PCI/VLB 1/2MB ..... $77/$140

Diamond
Stealth 64 PCI/VLB Video VRAM 2/4MB .. $279/485
Stealth 64 PCI/VLB DRAM 1/2MB ... $149/$199
Speedstar 64 PCI/ISA 1/2MB ..... $155/$205
Viper Pro PCI/VLB 4MB $559

ATI
Mach 64 VRAM PCI/VLB 2/4MB $279/489
Mach 64 DRAM PCI/VLB 1/2MB $169/239
#9 IMAGINE 128bit 2/4/8MB ..... CALL

MODEMS

14.4 Int Fax/Modem $59
14.4 Int Voice Fax/Modem $85
28.8 Int Fax/Modem $125
28.8 Int Voice Fax/Modem $145

MULTIMEDIA

Sound Boards

Creative Labs
Sound Blaster 16 MCD $8
Sound Blaster 16 SCSI-2 ..... $13
Sound Blaster AWE 32 ..... $29
Sound Blaster AWE 32 VE $22

CD-ROM Drives

Toshiba
3601 SCSI 4X Int $30
XM5301 4X SCSI $25
XM5302 4X IDE $19

Mitsumi/Panasonic
2X Internal $78
4X Internal IDE $179
Teac CD-55A 4X $165
Sanyo 4X SCSI $219
External SCSI -CD/Hard Drive Cases w/Power
Single/Double Bay $89/137

HARD DISK CONTROLLERS

IDE
ISA IDE/IO $15
ISA EIDE $45
ISA IDE/IO Enh Par & 16550's $39
VLB IDE/IO $25
VLB IDE/IO Enh Par & 16550's $39
VLB IDE Cache 0k/1MB ..... $119/$149
PCI IDE/IO Combo $55
PCI IDE Cache $185

SCSI

Adaptec
AHA-2940W PCI $339
AHA-2940 PCI $239
AHA-2842 VLB $245
AHA-2742 EISA $295
AIC-6360 VLB $125
SLIM SCSI $279
AMM-1570 SCSI w/Audio $299

HARD DRIVES

Maxtor
1260A 1260MB 11ms IDE $339
7850A 850MB 11ms IDE $239
7540AV 540MB 10ms IDE $199

Western Digital
2540 540MB 11ms IDE $199
31000 1080MB 10ms IDE $339
31200 1280MB 10MS IDE $355
31600 1620MB 9ms IDE $559

Conner
540A 540MB 12ms IDE $199
850A 850MB 10ms IDE $245
1275A 1.3Gig 10ms IDE $360
1080S 1GB 11ms SCSI $469
2147S 2.1 GB 9ms SCSI $799
4207S 4.2GB 9ms SCSI $1578

Seagate
3660A 540MB 12ms IDE $199
31220A 1GB 12ms IDE $339
31230N 1GB 9ms SCSI $489
32550N 2.1GB 8ms SCSI $979

Quantum
540MB Lightning11ms EIDE $199
1GB Fireball 12ms EIDE $319
1GB Fireball 11ms SCSI $459
2.1GB SCSI 8ms $969
4.2GB SCSI 8.5ms $1479
IOMEGA ZIP Drive $199
Call for Micropolis & Laptop Drives

LASER PRINTER MEMORY

HP II,IID & HP IIP,IIP+,III,IIID,IIIP
1MB $69, 2MB $95, 4MB $169
HP4L 1MB $50
HP4 Series 2MB $85, 4MB $165, 8MB $33
HPDeskJet 500 Series 256K $59
Panasonic 4410, 4430, 4420, 4450i
2MB $115, 4MB $185
Epson AL II, 1000,1100,1500,1600 5000,5200,7000,8000
2MB $125, 4MB $199
Canon, IBM, TI, NEC, OKI & More CALL

We Carry: Cases, Floppies, KeyBoards, Mice Ethernet, Laptop Acc. and Much More! Upgrades for All Major Brands, Including Packard Bell

THE FUTURE MICRO DIFFERENCE
- ©Easy Installation Instructions
- ©Free Technical Assistance
- ©30 Day Money Back Guarantee
- ©Overnight Delivery Available
- ©Accept PO's from Corporate, Gov't and Educational Inst.
- ©Gov't, Educational Discounts
- ©No Surcharge on Credit Cards

Se Habla Espanol

DISCOVER VISA MasterCard American Express Cards

Our sales staff is ready to provide advice on the most cost-effective 486 or Pentium upgrades for your computer.

We will buy CPU's and used or defective memory chips. Cash, Trade or Credit toward future purchase.

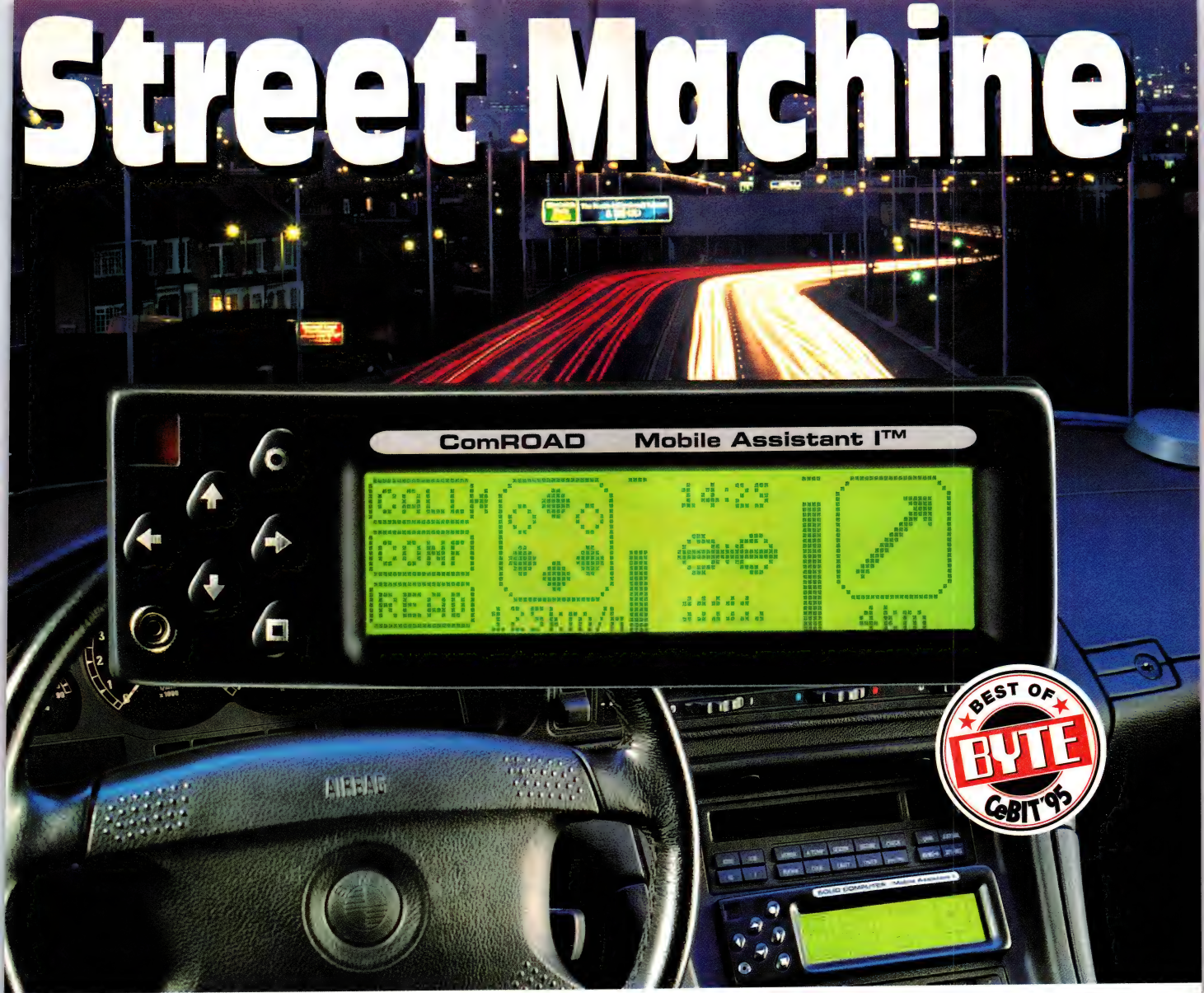
Future Micro, Inc. 2691 Richter Ave. #118, Irvine CA, 92714
(714) 622-9130 FAX (714) 622-9143
Customer Service /Tech Support (714) 622-9136

30 Day Money Back Guarantee

Terms and Conditions: 20% Restock fee on non-defective returns. No refunds after 30 days. Shipping charges are non-refundable. Not responsible for typographical errors. Prices subject to change without notice. Two year warranty on non-memory products, lifetime warranty on memory. RMA required for all returns.

800-700-6502

Street Machine



Up and away on the Information-Highway!

Mobile Assistant I™

– a multifunctional device for mobile communications, traffic and information management. It brings together all the latest technology such as radio modems, satellite navigation and computer power to give you the best service you can expect.

Mobile Assistant I™ is intended for professionals in areas such as:
Freight Carriers • Field Service Organizations • Field Sales Organizations • Rental Car Agencies • Police- and Fire-Departments • Emergency Road Service • Hazardous Materials and Security Transports • Public Transportation Systems.

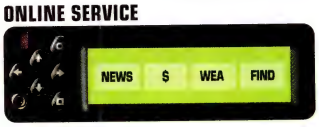
ONLINE NAVIGATION

TRAFFIC INFORMATION

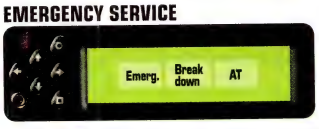
MOBILE OFFICE

FLEET-MANAGEMENT

ONLINE SERVICE



EMERGENCY SERVICE



ELECTRONIC TOLL COLLECTION

- **Wireless Communication Computer**
- **GPS, Computer, Modem**
- **Just 6-Keys**
- **Car Radio Size**
- **Supported Networks: MODACOM/ARDIS-MOBITEX/RAM - GSM/CDPD**

ComROAD®

Internet: http: //www.solidinfo.com

Circle 172 on Inquiry Card (RESELLERS: 173).

Germany Headquarter: Bruckmannring 32 • D-85764 Oberschleißheim • Tel: + 49-89-31 57 19-0 • Fax: + 49-89-3 15 91 46 • USA: Tel: 1-800•784•7243

MEMORY DISCOUNT HARD DRIVE WAREHOUSE

1-800-636-6792 HOURS: MON-FRI 9:00-9:00 SAT 10:00-4:00 EST **FAX 1-215-922-0116**

WE DEAL! CALL US LAST WITH YOUR BEST OFFER!

GOVERNMENT, EDUCATIONAL, CORPORATE & INTERNATIONAL ORDER SPECIALISTS

- 215-922-0050 EXPRESS International Order Line
- 215-922-4640 EXPRESS Technical Support
- 215-922-0116 EXPRESS FAX - Domestic - International
- 800-636-6792 EXPRESS Order Line - TOLL FREE
- Dedicated to serving Purchasing Agents Worldwide
- Pre-Approved Open Accounts for all Fortune 2000

PURCHASE ORDERS · VISA · MasterCard · DISCOVER · AMERICAN EXPRESS **NO SURCHARGE**

BEST BUY! 1995 HARD DRIVES

Seagate

FACTORY NEW 1-5 YEAR WARRANTY				
ST3491A	420MB	13MS	IDE	$149-316
ST3660A	545MB	11MS	IDE	175-329
ST5850A	850MB	11MS	IDE	224-379
ST31220A	1.05GB	9MS	IDE	279-453
ST31230N	1.00GB	10MS	SCSI-2	495-630
ST11900N	1.7GB	9MS	SCSI-2	999-1124
ST12400N	2.1GB	9MS	SCSI-2	949-1174
ST32430N	2.1GB	10MS	SCSI-2	835-968
ST43400N	3.5GB	11MS	SCSI-2	1100-1275
ST15230N	4.2GB	9MS	SCSI-2	1079-1394
ST410800N	9.0MB	8MS	SCSI-2	2450-2684
SCSI-BARRACUDA -7200 RPM				**INT-EXT**
ST32550N	2.1GB	8MS	SCSI-2	969-1094
ST15150N	4.2GB	8MS	SCSI-2	1469-1594

Maxtor

FACTORY NEW-2 YEAR WARRANTY				
M7405AV	425MB	12MS	IDE	170-300
M7540AV	540MB	12MS	IDE	180-330
M7850AV	853MB	12MS	IDE	239-389
M71260AV	1.2GB	12MS	IDE	305-475
M76226AP	1.6GB	12MS	IDE	430-590
MXT540A	540MB	8.5MS	SCSI	345-465
MXT540S	540MB	8.5MS	SCSI	345-465

CONNER

FACTORY NEW-1 YEAR WARRANTY				
CFS425A	420MB	13MS	IDE	$153-306
CFS540A	540MB	12MS	IDE	174-330
CFS850A	850MB	10MS	IDE	224-379
CFS1275A	1.3GB	10MS	IDE	278-480
CFP1080S	1.06GB	9MS	SCSI-2	449-584
CFP2105S	2.1GB	9MS	SCSI-2	840-1000
CFP2107S	2.1GB	9MS	SCSI-2	955-1080
CFP4207S	4.2GB	9MS	SCSI-2	1299-1424

NOTEBOOK HARD DRIVES

TOSHIBA

NOTEBOOK DRIVES/1 YEAR WARRANTY ON 2.5"				
MK1522FC	126MB	15MS	IDE	199
MK2326FC	340MB	15MS	IDE	299
MK2526FC	524MB	15MS	IDE	399
MK2428FC	520MB	15MS	SCSI	449
MK2626FC	810MB	13MS	IDE	499

IBM

IBMHDN520	520MB		IDE	$650

Seagate

ST9150AG	131MB	16MS	194
ST9385AG	340MB	16MS	269
ST9550AG	453MB	16MS	399
ST9655AG	524MB	16MS	409

Quantum

DY256AT	256MB	17MS	IDE	$259
DY514AT	514MB	17MS	IDE	415
DY256S	256MB	17MS	SCSI	399
DY514S	514MB	17MS	SCSI	429

CONNER

CFC350A	350MB	17MS	$288
CFC	64MB	17MS	322

FUJITSU

M2637T	240MB	17MS	$295

TAPE BACKUPS

HEWLETT PACKARD BEST BUY! 1995

35470A	2.0GB TAPE INT/EXT.....$789/899
35480A	4-8GB TAPE INT/EXT.....899/999
C1533A	4-16GB TAPE INT/EXT.....1099/1199
4MM 90MT DAT CART (1/5 PK).....18/86
4MM 120MT DAT CART (1/5PAK).....30/149
3.5"-5.25" CONVERSION KIT.....39

COLORADO MEMORY SYSTEMS

Jumbo 350 Internal	$149
Jumbo 700 Internal	209
Jumbo 1400 Internal	349
Trakker 350 parallel port	269
Trakker 700 parallel port	389
Powertape 2.0GB SCSI-2 DAT Int	927
Powertape 2.0GB SCSI-2 DAT Ext	1177
Powertape 4.0GB SCSI-2 DAT Int	1119

EXABYTE

4200C 4GB TAPE INT/EXT	999/1099
8205 2.5GB TAPE INT/EXT	1325/1549
8505 5GB TAPE INT/EXT	2025/2399
8505XL 14GB TAPE INT/EXT	2200/2498
1500 1.3 QIC INT	299

WangDAT

3100 2.0GB TAPE INT/EXT	$849/949
3200 4-8GB TAPE INT/EXT	899/999
3400DX 4-8GB TAPE INT/EXT	999/1099

MicroSolutions BACKPACKS

DOUBLE SPEED PARALLEL PORT CD ROM DRIVE $339
QUAD SPEED PARALLEL PORT CD ROM DRIVE 399
DSKTTE DRV 1.2, 5.25 175
DSKTTE DRV 1.4, 3.5 175
BACKPACK 250MB TAPE DRIVE 329
BACKPACK 900MB TAPE DRIVE 469
BACKPACK 420MB HARD DRIVE 469
BACKPACK 850MB HARD DRIVE 579

MEGA

Zip drive 100MB Parallel Interface...CALL/$199
Zip drive 100MB SCSI Interface.....CALL/199
Zip drive 100MB, 3pk.....CALL/69
Bernoulli 90 MB DR.....345
Bernoulli 150MB Internal SCSI 413
Bernoulli 150MB Internal IDE.....389
Bernoulli 230MB Insider SCSI.....474
Bernoulli 230MB Transportable 474
90 MB/150MB/230MB Cartridge.....99

CONNER

TapeStor 250MB Internal	$128
TapeStor 420MB Internal	169
TapeStor 420MB Parallel Port	319
TapeStor 850MB Internal	259
TapeStor 850MB Parellel Port	429
4320/50 Python 2GB up to 11MB int/ext	749/1039
4354XP Python IDA Turbo 22MB/min ext	1099
4326NP Python 4-8GB 5MB/sec ext	978
4356XP Python 4-8GB w/comp1MB Cache	1209
4324T Python 4GB Turbo int/ext	879/989

IBM PS/2

PS/2 50, 50Z, 60, 70, 80, P70, 55SX			
200MB	15MS	IDE	$349
420MB	13MS	IDE	399
540MB	12MS	IDE	499
540MB	12MS	SCSI	499
1.2GB	11MS	SCSI	799
MICROCHANNEL CONTROLLER			
IDE	16-bit	SCSI-2	$179
IBM PS/2 INTERNAL DRIVE KITS			
30-8086,30-286,25-8086, 25-286			
210MB		IDE	$299
420MB		IDE	349
540MB		IDE	449
1.0GB		IDE	569

IBM STANDARD

				INT-EXT
527MB	12MS	SCSI		$265-390
1.0GB	10MS	SCSI		599-724
2.04GB	7.5MS	SCSI	1300-1426	
4.25GB	11MS	SCSI	2149-2274	
527MB	12MS	IDE	246-396	
728MB	12MS	SCSI	325-475	
1.05GB	10MS	IDE	569-719	

digital

FACTORY NEW-3 YEAR WARRANTY				INT-EXT
DSP3107	1GB	9.5MS	SCSI	$794-919
DSP3210	2GB	9.5MS	SCSI	1149-1274
DSP5300	3GB	12MS	SCSI	1299-1324
DSP5400	4GB	12MS	SCSI	2479-2604

HEWLETT PACKARD

FACTORY NEW-5 YEAR WARRANTY				INT-EXT
C3323A	1.05GB	10MS	SCSI	$599-764
C2490	2.1GB	8.9MS	SCSI	999-1154

Quantum

FACTORY NEW-2 YEAR WARRANTY				
MAVERICK IDE & SCSI-2 SERIES				**INT-EXT**
3054MMA	540MB	14MS	IDE	189-339
30540MVS	540MB	14MS	SCSI	189-314
LIGHTNING IDE & SCSI-2 SERIES				**INT-EXT**
30540LTA	540MB	11MS	IDE	$189-339
30730LTA	730MB	11MS	IDE	239-389
30540LTS	540MB	11MS	SCSI	199-324
30730LTS	730MB	11MS	SCSI	269-394
TRAIL BLAZER SERIES				**INT-EXT**
30420TRA	420MB	12MS	ATA-2	169-N/A
30420TRA	420MB	12MS	FSCSI-2	179-304
30850TRA	850MB	12MS	ATA-2	199-N/A
30850TRA	850MB	12MS	FSCSI-2	269-394
THUNDERBOLT SERIES				**INT-EXT**
30420LPA	420MB	12MS	ATA-2	169-N/A
FIREBALL SERIES				**INT-EXT**
30540FBA	540MB	12MS	ATA-2	189-N/A
30540FBS	540MB	12MS	FSCSI-2	199-324
31080FBA	1.08GB	12MS	ATA-2	279-N/A
31080FBS	1.08GB	12MS	FSCSI-2	299-354
EMPIRE FAST SCSI-2 SERIES				**INT-EXT**
EMP2100S	2.1GB	8.9MS	3.5"X1	889-1114
CAPELLA FAST SCSI-2 SERIES				**INT-EXT**
VP32210S	2.2GB	8.5MS	3.5"X1	769-974
ATLAS FAST SCSI-2 SERIES				**INT-EXT**
XP32150S	2.1GB	8MS	7200RPM	870-1024
XP43400S	4.3GB	8MS	7200RPM	1499-1724
GRAND PRIX SCSI-2 SERIES				**INT-EXT**
GP34301S	4.3GB	8.6MS	7200RPM	1099-1224
GRAND PRIX SCSI-2 SERIES				**INT-EXT**
GP34301W	4.3GB	8.6MS	7200RPM	1299-1424

WESTERN DIGITAL

FACTORY NEW-3 YEAR WARRANTY				
WDAC2540	540MB	11MS	IDE	188-339
WDAC2850	850MB	10MS	IDE	215-374
WDAC31200	1.2GB	10MS	IDE	249-404
WDAC31600A	1.6GB	9MS	IDE	549-699

FUJITSU

FACTORY NEW-3 YEAR WARRANTY				
M2684T	530MB	13MS	IDE	$173-339
M2684S	530MB	13MS	SCSI	185-325
M1606S	1.1GB	9.5MS	SCSI	359-554
M2915S	2.1GB	9.5MS	SCSI	845-994
M2934S	4.3GB	8.9MS	SCSI	1139-1424

SAMSUNG

FACTORY NEW-2 YEAR WARRANTY				
S420	420MB	12MS	IDE	$149-399
D560	560MB	12MS	IDE	159-309

REMOVABLES/OPTICALS

SYQUEST

REMOVABLE CARTRIDGE DRIVES

270MB INTERNAL/EXTERNAL FOR PC.. $399/499
270MB EXT. FOR MACINTOSH.....499
270MB CART. SINGLES/5 PACK.....80/395
270 PARALLEL PORT.....599
270MB INTERNAL IDE.....399
CARTS: 44MB/88MB/105MB/200MB..54/59/75/85
5200 200MB INT/EXT.....399/599

FUJITSU

REWRITABLE EXTERNAL OPTICAL DRIVES

230MB 3.5" OPTICAL DRIVE INT.....$699
230MB 3.5" OPTICAL DRIVE EXT.....699
230MB 3.5" OPTICAL EXT FOR MAC.....699
230MB CARTRIDGE...1-PACK $29 5-PACK 129

FLOPPY DRIVES

TEAC

1.44MB.....$39
DUAL FLOPPY 1.44 & 1.2.....99

VIDEO BOARDS

ATI Graphics Xpression.....$195
ATI WinTurbo 2MB ISA, VLB, PCI.....285
Graphics Pro Turbo 2MB ISA, VLB, PCI..329
Graphics Pro Turbo 4MB ISA, VLB, PCI..465

SVGA

SVGA 256K.....$45
SVGA 512K.....55
SVGA 1024K.....88
SVGA 1MB VESA local bus.....88

BOCA RESEARCH

Voyager 1MB VL-Bus.....$125
Voyager 2MB VL-Bus.....195
SVGAP1 PCI SuperX VGA 1MB.....125

GVC Number Nine Computer Corporation

GXE 64 2MB VLB/PCI.....$249
GXE 64 Pro 2MB/4MB VLB,PCI..349/569
GXE 64 Pro 1600 2MB VLB,PCI.....569
GXE 64 Pro 1600 4MB VLB,PCI..699/719
9FX Vision 330 1MB/2MB.....147/339
9FX Motion 531 1MB.....194
9FX Motion 771 2MB/4MB.....329/459
Imagine128 4MB.....960
Imagine128 Pro 8MB.....1789

TRIDENT

SVGA 1024 X 768 1MB ISA VGA card..$88
SVGA 1024 X 768 1MB VLB VGA card..88

DIAMOND Multimedia Systems, Inc.

Speedstar Pro 1MB ISA, VLB.....$105
Speedstar 64 1MB/2MB ISA.....149/195
Stealth 64 DRAM 1MB VLB/PCI.....149
Stealth 64 DRAM 2MB VLB.....199
Stealth 64 VRAM 2MBPCI/VLB.....329
Stealth 64 VRAM 4MB-PCI/VLB.....469

WIDE SCSI HARD DRIVES

CONNER

FACTORY NEW-5 YEAR WARRANTY				
CPF1060W	1.06GB	10MS	3.5	$749

Seagate

FACTORY NEW-5 YEAR WARRANTY				
ST31200W	1.05GB	9MS	3.5"	$749
ST32550W	2.13GB	8MS	3.5"	1129
ST15150W	4.29GB	8MS	3.5"	1619

MICROPOLIS

FACTORY NEW-5 YEAR WARRANTY				
MC4221W	2.05GB	8.5MS	LP3.5	$1069
MC4123WW	4.30GB	8.5MS	3.5	1459
MC1991W	9.10GB	10MS	FH	2259
WIDE AUDIO VISUAL TUNED DRIVES				**INT-EXT**
MC4221WAV	2.05GB	8.5MS	LP3.5	$1120
MC3243WAV	4.30GB	8.5MS	3.5	1549
MC1991WAV	9.10GB	10MS	FH	2369

EXT. SCSI CASES

Half Ht for 3.5"IDE Drives for parallel port.....$109
Half Ht for 5.25" or 3.5" Devices (1Bay).....89
Full Ht for Non-RAID ROM's w/Audio Jacks.....99
JMR WIDE Chico 3.5" HH Device.....119
JMR WIDE Chico 3.5" Drive Case w/Term Cable....259
JMR WIDE Chico 5.25" Device.....109
5.25"Full Ht for (1) FH or (2) HH Devices (2 Bay)....149
5.25"Double Full Ht for (2) FH Devices (4 Bay).....219
5.25"3-Full Ht & 1HH or 7HH Devices (7 Bay).....349
Removable Rack Frame for 3.5" HD SCSI or IDE.....39

NEC

21/2" REMOVABLE LAPTOP DRIVES	VERSA E, M, V, P
340MB	$595
524MB	$895
710MB	$995
810MB	$1095
1.2GB	$1695

IBM THINKPAD 750, 755 360

21/2" REMOVABLE LAPTOP DRIVES	
340MB	$595
524MB	$895
710MB	$995
810MB	$1095
1.2GB	$1695
THINKPAD 700, 720	
340MB	$995
524MB	$1295
720MB	$1495
THINKPAD 701	
540MB	$945
720MB	$1195

CD ROMS

SANYO

SH93R Double Speed SCSI-2 Int/Ext...$140/249
SH254S Quad Speed SCSI-2 Int/Ext.....245/345

LEXTOR

PX-43CS	Internal 4-Speed, 256K Cache	$319
PX-45CS	External 4-Speed, 256 Cache	449
PX-43CS	Internal 4-Speed, 1MB Cache	399
PX-43CH	External 4-Speed, 1MB Cache	529
PX-45CHM	Ext 4-Speed, 1MB Cache MAC	529
PX-63CS	Int 6-Speed, 256K Cache	479

CHINON

CDS545 Quad Speed IDE Int/Ext.....$179/329
CDS525 DS SCSI II Int/Ext.....125/250

MITSUMI

CRMC-FX400 Quad Speed Int/Ext IDE $189/325

SONY

CDU-55E 2X int/Ext.....$149/274
CDU-55S SCSI 2X Int/Ext.....165/290
CDU-76S/B SCSI 4X Int/Ext.....249/399
CDU-76 IDE 4X Int/Ext.....229/349

TOSHIBA

3601 SCSI 4X Internal/External.....309/453
XM5302A Quad Speed IDE Int/Ext.....199/349

TEAC

CD-55AB SuperQuad 4X AT Drive.....$189
CF-506A ComboQuad 4X CD w/1.44 floppy.....239

SCSI-IDE CABLES

HARD DRIVE EXTERNAL CABLES	
CENTRONICS 36 TO SCSI-II	$50
CENTRONICS 50 TO MAC 25-PIN	18
CENTRONICS 50 TO CENTRONICS	23
CENTRONICS 50 TO CENTRONICS 50 6FT	23
CENTRONICS 50 TO CENTRONICS 50 3FT	20
CENTRONICS TO DB-50	50
DB-50 TO SCSI-II	50
DB-50 TO DB-50	50
SCSI-II TO SCSI-II	50
FAST WIDE SCSI-II TO CENTRONICS	100
68 PIN WIDE TO WIDE 3FT/6FT	69/79
HARD DRIVE INTERNAL CABLES	
SCSI 50-PIN RIBBON 2/3/4 DEVICE	$5/9/12
SCSI 50-PIN RIBBON 5/6/7 DEVICE	14/18/22
SCSI FAST 68-PIN WIDE 3 CONN.4 DEVICE	65
SCSI FAST 68-PIN WIDE 5 CONN.4 DEVICE	99
SCSI FAST 68-PIN WIDE 8 CONN.7 DEVICE	139
IDE 40-PIN RIBBON 3 CONNS.	9
FLOPPY & IDE CABLES SET	11

EDO MEMORY

4MB/8MB EDO	190/390
16MB/32MB EDO	750/1695

72 PIN/32 BIT NON PARITY

1X32-4MB-70NS/60NS	155/165
2X32-8MB-70NS/60NS	305/325
4X32-16MB-70NS/60NS	512/532
8X32-32MB-70NS/60NS	1095/1145

$32 PER MEGABYTE Price is based on the 1MB option. Modules sold as 1MB Modules. Intel price is $512 for 4x32-70ns 16MB Module.

MEMORY FOR PC's, WORKSTATIONS, PORTABLES & PRINTERS

BEST BUY! 1995 SIMMS

LIFETIME WARRANTY

CALL FOR PRICING & AVAILABILITY OF MEMORY LISTED BELOW

ALR·APPLE·AST·AT&T·BROTHER·CANON·COMPAQ·DELL·DIGITAL·EPSON·EVEREX·HEWLETT-PACKARD·IBM·LEXMARK·NEC·OKIDATA·PANASONIC·SHARP·SUN·SILICON GRAPHICS·TEXAS INST.·TOSHIBA·SRAM·FLASH AND MORE

30 PIN PARITY/9-BIT

4MB X 9-80NS SIMM 3 CHIP	$139
4MB X 9-70NS SIMM 3 CHIP	139
4MB X 9-60NS SIMM 3 CHIP	145
4MB X 9-80NS SIMM 9 CHIP	155
4MB X 9-70NS SIMM 9 CHIP	165
4MB X 9-60NS SIMM 9 CHIP	169
1MB X 9-100NS 9 CHIP SIMM	40
1MB X 9-80NS 3 CHIP SIMM	42
1MB X 9-80NS 9 CHIP SIMM	44
1MB X 9-70NS 3 CHIP SIMM	42
1MB X 9-70NS 9 CHIP SIMM	44
1MB X 9-60NS 3 CHIP SIMM	42
1MB X 9-60NS 9 CHIP SIMM	48
16MB X 9-70NS SIMM	595
16MB X 9-60NS SIMM	625
256K X 9-80NS SIMM	14
256K X 9-70NS SIMM	15
256K X 9-60NS SIMM	18

30 PIN NON-PARITY/8 BIT

1MB X 8-80NS SIMM	40
1MB X 8-70NS SIMM	40
4MB X 8-80NS SIMM	145
4MB X 8-70NS SIMM	150
4MB X 8-60NS SIMM	155

30 PIN 9 BIT SIPPS

1MB X 9-100NS SIPP	43
1MB X 9-80NS SIPP	49
1MB X 9-70NS SIPP	50
1MB X 9-60NS SIPP	51
256K X 9-80NS SIPP	19
256K X 9-70NS SIPP	20

72 PIN/36 BIT PARITY

256X36-1MB-70NS	55
512X36-2MB-70NS	95
1X36- 4MB-70NS/60NS	165/175
1X36- 4MB-70NS/60NS MAJOR	175/185
2X36-8MB-70NS/60NS	330/350
2X36-8MB-70NS/60NS MAJOR	350/360
4X36-16MB-70NS/60NS	535/545
4X36-16MB-70NS/60NS MAJOR	650/660
8X36-32MB-70NS/60NS	1225/1275
16X36-64MB-70NS/60NS	2595/2645

INTEL

80287-5MHZ	140	
80287-8 8MHZ	129	
80287-10MHZ	69	
80287-8 8MHZ	59	
80287-8 8MHZ	59	
80287-10 10MHZ	75	
80287XL 10MHZ	75	
80287XL 12MHZ	75	
80387SX-16 16MHZ	75	
80387SX-20 20MHZ	75	
80387SX-25 25MHZ	75	
80387SX-25 25MHZ	75	
80387SX-28 28MHZ	75	
80387DX-16 16MHZ	75	
80387DX-20 20MHZ	75	
80387DX-25 25MHZ	75	
80387DX-33 33MHZ	75	
80387SX-16 16MHZ	75	
80387SX-20 20MHZ	75	
80387SX-25 25MHZ	75	
80387SX-25 25MHZ	75	
80387SX-28 28MHZ	75	
80387DX-16 16MHZ	75	
80387DX-20 20MHZ	75	
80387DX-25 25MHZ	75	
80387DX-33 33MHZ	75	
80387DX-40 40MHZ	75	
80387SX-16 16MHZ	75	
80387SX-20 20MHZ	75	
80387SX-25 25MHZ	75	
80387SX-25 25MHZ	75	
80387SX-28 28MHZ	75	
80387SX-33 33MHZ	75	

CYRIX

83D87-16 16MHZ	59	
83D87-20 20MHZ	59	
83D87-25 25MHZ	59	
83D87-33 33MHZ	59	
83D87-40 40MHZ	69	
83D87SX-16 16MHZ	59	
83D87SX-20 20MHZ	59	
83D87SX-25 25MHZ	59	
83D87SX-28 28MHZ	59	
83D87SX-33 33MHZ	59	

AMD

3D87-16 16MHZ	59	
3D87-20 20MHZ	59	
3D87-25 25MHZ	59	
3D87-33 33MHZ	59	
3D87-40 40MHZ	69	
3D87SX-16 16MHZ	59	
3D87SX-20 20MHZ	59	
3D87SX-25 25MHZ	59	
3D87SX-28 28MHZ	59	
3D87SX-33 33MHZ	59	

INTEL

3D87-16 16MHZ	59	
3D87-20 20MHZ	59	
3D87-25 25MHZ	59	
3D87-33 33MHZ	59	
3D87-40 40MHZ	69	
3D87SX-16 16MHZ	59	
3D87SX-20 20MHZ	59	
3D87SX-25 25MHZ	59	
3D87SX-28 28MHZ	59	
3D87SX-33 33MHZ	59	

INTEL

3D87-16 16MHZ	59	
3D87-20 20MHZ	59	
3D87-25 25MHZ	59	
3D87-33 33MHZ	59	
3D87-40 40MHZ	69	
3D87SX-16 16MHZ	59	
3D87SX-20 20MHZ	59	
3D87SX-25 25MHZ	59	
3D87SX-28 28MHZ	59	
3D87SX-33 33MHZ	59	

AMD

4860DX4-100	213	
PENTIUM-60	229	
PENTIUM-66	249	
PENTIUM-75	259	
PENTIUM-90	309	
PENTIUM-100	465	
PENTIUM-120	708	
PENTIUM-133	931	

CYRIX

486SLC-50	$45	
486SLC-50	99	
486SLC-33	88	
486SLC-40	116	
486DX-50	249	
486DX2-50	147	
486DX4-75	183	

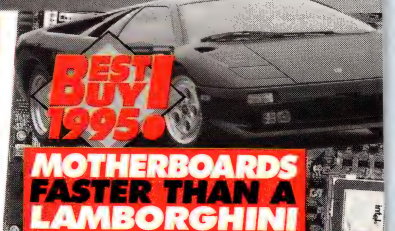
INTEL

3D87-16 16MHZ	59	
3D87-20 20MHZ	59	
3D87-25 25MHZ	59	
3D87-33 33MHZ	59	
3D87-40 40MHZ	69	
3D87SX-16 16MHZ	59	
3D87SX-20 20MHZ	59	
3D87SX-25 25MHZ	59	
3D87SX-28 28MHZ	59	
3D87SX-33 33MHZ	59	

AMD

4860DX4-100	213	
PENTIUM-60	229	
PENTIUM-66	249	
PENTIUM-75	259	
PENTIUM-90	309	
PENTIUM-100	465	
PENTIUM-120	708	
PENTIUM-133	931	

MOTHERBOARDS FASTER THAN A LAMBORGHINI



INTEL

	MOTHER BOARDS	BOARD ONLY
PENTIUM-66	$195	$46
PENTIUM-75	195	49
PENTIUM-90	269	59
PENTIUM-100*	269	69
PENTIUM-120*	269	89
PENTIUM-133*	269	129
486DX-33	145	24
486DX2-66	145	25
486DX4-100	145	29

256K CACHE, PCI SLOTS, 3 16-BIT ISA SLOTS (FAST IO & ENHANCED IDE BUILT ON*), 72 PIN SIMM SOCKETS

256K CACHE/7-ISA /2-VLB/ AMI-BIOS/8-30 PIN OR 4-30 PIN & 2-72 PIN OR 4-72 PIN

INTEL ZAPPA PENTIUM MOTHERBOARDS

Intel Motherboards have 3 PCI Slots, 16 Bit Slots, up to 256MB RAM 256K Cache, Built on IDE, Parallel, Serial & Floppy Support

P5-90	$599
P5-100	$699
P5-120	$899
P5-133	$1299

PROCESSOR UPGRADES

Cyrix CYRIX 386 TO 486 UPGRADE

- 386SX systems, use CX486SRX.....$1
- 386DX-16 systems, use CX486DRX2-33...1
- 386DX-20 systems, use CX486DRX2-40...1
- 386DX-25 systems, use CX486DRX2-50...1
- 386DX-33 systems, use CX486DRX2-66...1

intel

- Intel OverDrive® SX2/50..$1
- Intel OverDrive® DX2/50...1
- Intel OverDrive® DX2/66...1
- Intel OverDrive® DX4/100..2
- Intel OverDrive® DX4/100..2

INTEL UPGRADES Intel Pentium 63.....3

TRANTOR

T160 16-Bit SCSI	$8
T348 Parallel Port to SCSI Plus	14
T358 Parallel Port to SCSI Plus Enhnc	19

Q-LOGIC

QL-ISACD 16-Bit ISA for CD ROMs	$4
QL-ISA-FL 16-Bit ISA ISA/IDE	125/13
QL-VLB-FL 32-Bit ISA VLB/VLB-FL	189/20
QL-EISA/FL 32-Bit ISA EISA/EISA-FL	199/2
QL-PCMCIA PCMCIA Corsel SCSI Drivers	17
QL-VLB-FL 32-Bit PCI Bidirectional Level	12
QL-PCI-10 32-Bit IQ-PCI Wide SCSI-2	29
QL-PCI-W 32-Bit IQ-PCI Model 10 Narrow	2

DTC

2278VL IDE/FDD/1P/1S/1G	$2
2277VL VL-Bus Caching IDE (Up to 16 MB)	13
2139PC PCMCIA	2
2280 IDE/FD/1 P/2S/1 G	2
2290 EISA IDE 32-Bit	13
2120VL SCSI-2 /Bus/IDE/FDD/HDD	11
3280AS SCSI-2/4-FDD	11
3290AS EISA SCSI-2/4-FDD	33
CD-ROM Kit SCSI-2 Bit	4

Accoutics

s-IDE-1/16 8BIT XT Cont. w/Bios	$4
s-IDE-2 PCI 2HD/Enhanced IDE	3
s-IDE-3 2 Floppy 2HD IDE Card	3
s-IDE-3+ 2HD/2FD w/ Bios 2.88 Support	5
s-IDE4/HP 2HD/2FD 16550 IO 2.88 Support	18
s-IDE-4+ 2HD/2FD	9
s-IDE4/VL 2HD/2FD 16550 2.88 Sppt VLB Enhn	9
ISAsport 16bit SCSI-Kit Model 20	12
VESAport MUL VLB w/Sound Card M/20	24
PCIsport Modl 20 w/wide SCSI-3 Support	24
PCIsport Mod 40 w/wide SCSI-3	29

Buslogic

KT445C 32-Bit VLB Fast SCSI-2 Kit	$19
KT545C 16-Bit ISA BusMaster Fast SCSI-2 Kit	20
KT742A 32-Bit EISA SCSI-2 Kit	28
KT747C 32-Bit EISA Fast SCSI-2 Kit	29
BT757S 32-Bit EISA Fast Wide SCS Card	34
SW-190 Software Drivers for BT757S	4
KT946C 32-Bit PCI Fast SCSI-II Kit	29
KT956C 32-Bit PCI Fast Wide SCSI-2 Kit	32

IDE CACHE CONTROLLERS

KT510A ISA/IDE Cache Controller	9
KT410A VESA/IDE Cache Controller	12
KT910A PCI/IDE Cache Controller	16

SUPER CONTROLLERS

IDE CONTROLLERS

200	2HD/2FD Controller Cables	$22
211	2HD/2FD w/2 serial/1 Par/1 Game	29
243	2HD/2FD VLB IDE w/o 2s/1p/1g	49
400	16550 2HD/2FD 2-16550 2s/1p/1g ISA	95
500	16550 2HD/2FD 2-16550 2s/1p/1g VLB	99

HI PERFORMANCE IDE CONTROLLERS

11	8-Bit 4FD & 2SIMB Tape Accel Card
21	2HD, 4FD (up to 2 IDE)
32	8Multi-port IDE, Ppy, Tape, & I/O Accel

MODEMS

U.S. Robotics

Sportster 28.8/14.4, V.34 Int	$224
Sportster 28.8/14.4, V.34 Ext	242
Sportster 14.4/14.4 Int/Ext	119/139
Sportster VI 28.8/14.4 Int	259
Sportster 14.4/14.4, Ext	119
Courier V.34 28.8/28.8 Int	99
Courier V.34 28.8/28.8 Int/Ext	389/449
Courier 28.8 Ext for PC Dual Standard	599
Courier 28.8 PCMCIA V.34 w/SW & Cable	469

intel

| |

ATI Free Shipping in USA for all Systems

CUSTOM SYSTEMS FROM ATI

72 HOURS BURN IN
USA BUILT

MB & CPU	Practice System	Family System	Deluxe System
	· Motherboard & CPU · 4MB of RAM 70nsec * 8MB for Pentium Systems · 420MB Hard Drive · 3.5" Floppy Drive 1.44mb · 1MB SVGA CARD 1024 x 768 · 14" SVGA monitor 0.28DP · Minitower Case 230WT PS · 101 Enhanced Keyboard · Mouse 3Button Free Preinstalled Software · DOS 6.22 & Windows 3.11	· Practice System With.... · Double Speed CD ROM · Stereo Card 16Bit/MIDI · 24/96 Fax/Modem MNP5 · Stereo Speakers *Preinstalled Software Bundle* · Compuserve/America on Line · Fax/Modem for Windows · Sound Mixer Bundle for Windows · DOS 6.22 & Windows 3.11	· Practice System With.... · 8MB RAM · 540MB Hard Drive · Dual Speed CD ROM · Stereo Card 16Bit/MIDI · Stereo Speakers *Preinstalled Software Bundle* · Compuserve/America on Line · Sound Mixer Bundle for Windows · DOS 6.22 & Windows 3.11
PENTIUM120 PCI, 256k	899	1699	1779	1799
PENTIUM 100 PCI, 256k	599	1399	1479	1499
PENTIUM 90 PCI, 256k	499	1299	1379	1399
PENTIUM 75 PCI, 256k	399	1199	1279	1299
486DX 4/100 VLB,256k	229	929	1029	1279
486DX 2/80 VLB,256k	199	899	999	1149
486DX 2/66 VLB,256k	179	879	979	1129
486DX 2/50 VLB,256k	169	869	969	1119

TRY BEFORE YOU BUY ! Over 200 fully working demos of commercial applications may be preinstalled with every system, and if you like it then buy it includes programs from Microsoft, Borland, Lotus, etc. Also includes over $250 worth of fully working programs. **For Only $ 9.99 upgrade code TDR**

CUSTOM UPGRADES

Code	Description
4MB70	4Mb RAM.....add $ 139
540 MB IDE Hard Drive	....Call for best Price
1.0 GB IDE Hard Drive	.....Call for best Price
1.2 GB IDE Hard Drive	.....Call for Best price
1.2FD	1.2 Floppy Drive.....add $ 43
14.4FMI	14.4 Fax/Modem.....add $ 55
FMV	14.4 Fax/Modem/Voice....$ 69
28.8FMI	28.8 Fax/Modem.....$ 119
NE2000C	NE2000 Card.....$ 34

Code	Description
MTw	MediumTower Case 230Wt PS.....$ 25
FTw	Full Tower Case 250WT PS.....$ 45
GM1	Game Pad 6 button, 3D.....$ 29
JST	Joystick 3Button, Great for Games....$ 9.99
MSIR	Cordless Mouse, no wires, 400DPI.....$ 29.99
D64P1	Diamond Stealth 64PCI 1MB.....$ 119
D64V1	Diamond Stealth 64VLB 1MB.....$ 119
V2M	Add 1MB of Video RAM.....$ 49

CALL FOR ANY OTHER UPGRADES

Code	Description
4XCD	4 X Speed CD ROM.....add $ 99
C420M0T	420MB TapeBackUp....add $ 159
3BTRB	3B TrackBall.....add $ 19
SRGP	SurgeProtector.....add $ 4.99
14"NI	14" NI SVGA Monitor...add $ 39
15"NI	15" NI SVGA Monitor...add $ 99
17"NI	17" NI SVGA Monitor....add $ 299
FAN486	486DX CPU Fan..... add $ 9.99
FAN586	Pentium Cooling Fan...add $ 18
CDTL	14 CD titles.....add $ 49

incl. Comptons Encyc.,RoboCop 3D, Etc

WHY BUY FROM ATI ?

Our systems are built to the highest standard
Using only best parts,
Guaranteed IBM compatible
Hassle free preinstalled & configured software
5 Year Warranty on systems call for details

MONTHLY SPECIAL
486 DX 100 Mhz
BLUELIGHTNING

Only:
$1299
PN MMI100

FREE !!! SOFTWARE

- Comptons Encyclopedia
- The Chess Master
- US Atlas
- World Atlas
- Mavis Beacon Typing
- Life & Death II
- Contraption Zack
- Robocop 3D
- F29 Retaliator
- PushOver
- Might & Magic II
- Epic Ocean
- Sound Mixer
- CD Player
- Fax for Windows
- Modem for Windows
- Internet Software
- America On Line

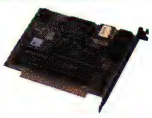
- 486 DX 100 VESA/PCI LB 256k CACHE
- 4MB RAM up 64MB
- 420MB Hard Drive
- 3.5 Floppy Drive
- 1MB SVGA VIDEO
- Double Speed CD-ROM
- 16Bit Sound/Midi Card
- 14" SVGA Monitor NI 0.28
- 20Wt Speakers Built In
- Free 14.4 FAX/MODEM
- 101 Enhanced Keyboard
- 3Button Mouse
- DOS 6.2 & Windows 3.11

3 year warranty on mainboard

MMC80 486DX2/80Mhz 1229
MMC66 486DX2/66Mhz 1199

MONTHLY SPECIAL SALE

MULTIMEDIA FAX MODEM VOICE



Up to 57.7 kBps Data
14.4 fax/Modem
Voice/Data/Fax Autoswitch
Voice Mail
Simple Installation

Pager Notification,
Remote Message retrival
Including software

Only: $ 69
PN# FMV

SIMM MEMORY

1MB x 3-70nsec .....$ 35.99
4MB x 9-70nsec .....$ 139.99
4MB 1x32-70nsec ...$ 145.99
8MB 2x32-70nsec ...$ 289.99
16MB 4x32-70nsec ..$ 499.99

BEST 486 DX MOTHERBOARDS

Takes 486 SX/DX/DX2/DX4/Pentium P24 with CPU
Deep Green Design, Pentium ready ZIF Socket
Up to 1 MB Cache, 256k Installed
Up to 64MB RAM
2 x 72pin & 4x 30pin SIMM
3VESA & 7ISA SLOTS,
AWARD BIOS
Standard baby AT
Uses Parity & Nonparity SIMM

BEST BUY

PN	CPU	Price $
4MB100	486DX4/100	229
4MB80	486DX 2/80	199
4MB66	486DX 2/66	179
4MB501	486DX 2/50	169

HARD DRIVE SALE

1.2GB IDE. . . $ 289
Call for Current sale Item
1GB IDE . . . .$ 279
Call for Current sale Item
540MB IDE . .$ 169
Call for Current sale Item
420MB IDE . .$ 158
Call for Current sale Item

CALL FOR ANY DRIVE

VIDEO SUPERSALE

Diamond Stealth, 2MB PCI...$ 199
1024 x768, add $ 155 for 4MB
Diamond Stealth, 1MB VLB...$ 109
1024x768, add $55 for 2MB
Trident 9440, 1MB VLB/PCI..$ 89
1024 x768, add $ 55 for 2MB
Trident 9400, 1MB VLB.....$ 75
1024 x 768, add $ 55 for 2MB
Trident 8900, 1MB ISA.....$ 69
1024 x 768
Oak 8770, 1MB ISA.....$ 59
1024 x 768, Win Accel.

ALL PARTS TESTED PRIOR TO SHIPPING !

GlidePoint by ALPS
- 400 DPI
- Serial
- No setup req.
- Replaces Mouse

NEW

Only: $ 79

Our policy is to satisfy every customer. That's why we offer a 30 days risk free guarantee and stand behind every sale. If you are not happy with your purchase we will gladly exchange the product or issue a credit less handling and shipping cost. There is NO CASH REFUNDS after 15 days store credit only or exchange.
All returns must be in original condition and packaging or we can not accept them for return.
We reserve the rights to refuse for return or charge up to 20% restocking fee.
All returns or repairs must be shipped back to ATI freight prepaid and insured, bearing RMA number on the package
· ALL PRICES ARE FINAL· SHIPPING & HANDLING ARE EXTRA and NONREFUNDABLE· ALL PRICES REFLECT 3% CASH DISCOUNT· ALL SALES ARE MADE FOB SUNNYVALE, CA· PRICES ARE SUBJECT TO CHANGE· NOT RESPONCIBLE FOR TYPOS · 15% RESTOCKING FEE ON ALL RE TURNS FOR REFUND

A.T. INC
550 LAKESIDE DR. SUNNYVALE. CA 94086

To Order Call
1-800-858-2173

FAX ORDERS: 408-774-9011
RMA & TECH-SUPPORT 408-774-9010

Free ground shipping for all systems over $ 1000

Circle 178 on Inquiry Card (RESELLERS: 179).

The Micro International 7600 Notebook.

THE BEST NOTEBOOK VALUE COMES FROM HOUSTON!

Raw power is *just the beginning* of what you get for only

$2660.

Brilliant 10.3" Dual-scan Passive Matrix Color screen (Active Matrix also available).

PENTIUM® PROCESSOR 90 MHZ

Built-in multimedia speakers for the built-in soundblaster compatible 16-bit soundcard !

Two type II PCMCIA card slots (equal to 1 type 3)

340mb removable local bus HD (up to 810mb available)

8mb RAM (up to 40mb using user-upgradeable modules) and 256K L2 cache!

Mic in / Speaker / Headphone out jacks

3.5" floppy drive

19mm trackball in just the right spot

Dependable NiMH Battery

A focus on service and support since 1984!

We give you *free* lifetime *toll-free* tech support. We *preload* the latest versions of DOS and Windows for Workgroups, including all video, sound, and PCMCIA card utilities. Our 1 Year Parts and Labor Warranty* includes an outstanding 48 hour warranty service turnaround time, *proving* that we understand how you depend on our products. Our 30-day money back guarantee is *pretty simple*: you get a refund* if you're not satisfied *for any reason*. Our RealHelp disk included with every notebook allows us to service your technical configuration files *by remote access*. Our 48-hour+ extensive burn-in and testing period on every single notebook, *before* it leaves our facility, ensures an absolute minimum of failures in *your notebook*. Anything less is just not mint!

*Optional extended and cross-shipment warranties are also available.
Shipping and handling charges will be withheld from all refunds.

Micro International, 10850 Seaboard Loop, Houston, Texas 77099. Top quality service and support ***since 1984!***
Full information (including specifications, all options & prices) available by fax or mail on request.
Fax (713) 495-7791 Hours: 8-6 Monday-Friday. Call today toll free:

*Pentium is a registered trademark of Intel Corporation.

1-800-967-5667

Circle 164 on Inquiry Card.

Control PC, Macintosh, and Sun Computers from 1 Console!

- **Supports any mixture of PC/Macintosh computers and Sun workstations - up to 4 in all**
- **Any platform's peripherals work with any type of computer in the system**
- **Full multimedia capabilities; keyboard, mouse, video, microphone, speakers, and serial port available**
- **Multiple users can access different computers simultaneously**
- **Convenient desktop size unit**

COME SEE US AT
Networld+Interop in Atlanta, GA, Sept 27–29, Booth #5166

An Inc. 500® Company

AUTOBOOT
COMMANDER 1xP™

CYBEX™

Cybex Corporation
4912 Research Drive Huntsville AL 35805 USA
(205) 430-4000 (205) 430-4030 fax

PC is a registered trademark of International Business Machines Corporation. Macintosh is a registered trademark of Apple Computer, Inc. Sun is a trademark of Sun Microsystems. Cybex, Commander, AutoBoot, and 1xP are trademarks of Cybex Corporation.

Dealer Program Available

Made in USA

Circle 152 on Inquiry Card (RESELLERS: 153).

YOUR FIRST SOURCE FOR MEMORY!

ALL YOU NEED TO KNOW IS THE NAME OF YOUR PC!

Our upgrade experts have detailed configuration information on thousands of computers and printers, from the oldest to the latest models. We provide you with an **"Easy Upgrade"** by providing you with the following information:

1. Your System Memory Features **2.** How Much Memory You Really Need **3.** Memory Products Available for Your System
4. The Most Cost Effective Upgrade Path for Your System **5.** Your Systems Minimum and Maximum Memory Capabilities

First Source International takes the confusion out of your memory purchase.
Take advantage of our service and the savings!

MONEY BACK 30 DAY Guarantee

WE SET THE STANDARD!

100% GUARANTEED
Memory Guaranteed - 100% Compatible in form, fit & function

LIFETIME WARRANTY
On all Paragon Memory & Kingston Technology products

EASY TO INSTALL
All products user installable, installation instructions included with most memory products

FREE SUPPORT
Free technical support & direct dial lines for immediate response

SPECIAL PRICING
Government & educational pricing, special volume pricing

PLUS . . .
Overnight delivery available
No surcharge on credit cards
Corporate PO's, APO/FPO's welcome

WHY SETTLE FOR LESS!

$6 FedEx Economy Two-Day℠ Service Up to 5lbs. FedEx Federal Express

HOURS
Monday - Friday • 7am - 5pm, PST
Saturday, 9am - 3pm *(orders only)*

The Only Source First SOURCE International For Computer Hardware & Software

MAIL OR FAX ORDERS TO:
(714) 448-7750 • FAX: (714) 448-7760
Compuserve Address: MHS:SALES@1SOURCE
First Source International
7 Journey • Aliso Viejo, California 92656

PERSONAL COMPUTER MEMORY

CACHE CHIPS 32 x 8–15ns.....$6 32 x 9–15ns.....$7

AST

Premmia GX P/100, P/90
8MB 501565-001.....$309 16MB 501566-001.....$609
32MB 501567-001.....$1,007 64MB 501568-001...$1,999
Premmia MTE, SE P/60
4MB 501159-001.....$190 8MB 501159-002.....$357
16MB 501159-003.....$712 32MB 501159-004...$1220
Bravo 386-SX, WS/286, 386
2MB 500510-002.....$88 4MB 500510-008.....$195
Bravo 3/25s
2MB 500710-004.....$89 8MB 500824-002.....$306
Advantage! Plus 486DX/33; DX2-50; DX2-66
4MB 501168-001.....$158 8MB 500824-001.....$329
Advantage! and Advantage! Pro 386SX/20; 25, Bravo 3/33s
2MB 500962-001.....$80 8MB 500962-002.....$272
Advantage! Pro 486DX/33; SX/25
Bravo LC, LC II, LP and MT
Special 256k cache 501284-004...$69 4MB 500987-002.....$151
1MB Video Upgd 501507-001.....$72
16MB 500987-004.....$518 32MB 500987-005...$1089
Premium 386/25; 33; 33T and Premium II 386SX/16; 20; 25
1MB 500780-003; 002.....$45
Premium 386/33T, 386SX/16 and Premium II 386SX/20; 25
4MB 500780-004.....$174
Advantage! 486/25; 33; 33p; SX20, Premium Server SE 4/33
Power Premium and Premium TE all models
Premium II 386/25; 33, 486/33, 486SX/20
8MB 500780-001.....$298

DELL

Optiplex ME and V models, PowerEdge XE models
Performance L, M and T models
4MB 310-3325.....$151 16MB 310-3327.....$525
Power Desktop and Low Profile Power Desktop models
1MB 310-2505.....$49 4MB 310-2507.....$151
16MB 310-2625.....$575
PowerLine Workstation DE and SE models
2MB 310-2466.....$99 4MB 310-2467.....$190
8MB 310-2468.....$305 16MB 310-2469.....$712
Performance ME models
8MB 310-3335.....$305 32MB 310-3337.....$1220

ZENITH

Z-400+, Z-Station SEh, SEn, Sh, Sn, DEh, Dh and Xen
Z-300/400 Series, Z-420/SX, Z-425/SX, Z-433/DX; SX
4MB ME-100.....$179 16MB ME-90.....$610

COMPAQ

Presario 500, 700 and 900 series
4MB 147522-001.....$159 8MB 147523-001.....$307
16MB 147524-001.....$549 32MB 147525-001...$1019
ProLiant 2000 and 4000 series, Systempro XL
16MB 149949-001.....$709 32MB 149912-001...$1426
64MB 149913-001.....$2436 128M 149914-001...$4595
ProLinea 3/25s; 3/25zs
2MB 141738-001.....$89 8MB 141742-001.....$304
Presario 600 and 800 series, ProLinea 4/25, 4/33, 4/50, 4/66
ProLinea MT and ProLinea Enhanced series, ProSignia VS
4MB 141684-001.....$153
8MB 141685-001.....$307

HEWLETT-PACKARD

Vectra VL2, XP, XU, M2, N2 and XM2 models
Netserver LM, LC and LF models
4MB D2974A.....$179 8MB D2975A.....$356
16MB D2297A.....$609 32MB D2298A.....$1152
Vectra QS and RS models
4MB D1542 or 1642A.....$177
Vectra 486 M, MI, N, NI and XM models
2MB D2381A.....$95 8MB D2152A.....$305
4MB D2156A.....$151 16MB D2676A.....$611
Vectra 386/25, 486/25U; 33U; 33ST; 50U; 66U and 66ST
2MB D2381A.....$95 8MB D2152A.....$357
Vectra 386/33N; NI models
2MB D2714A.....$92 8MB D2715A.....$304

IBM

Aptiva 300, 500 and 700 series
4MB n/a.....$159 16MB n/a.....$509
Eduquest 55
4MB 74G1299.....$174
Eduquest 30 , 40 and 50 models
4MB 60G0896.....$174 16MB 60G0898.....$549
PS/1 286; 386SX
2MB 92F9935.....$83 4MB 92F9694.....$163
Valuepoint Performance models
4MB 92G9201.....$179 8MB 92G7520.....$354
PS/1 Consultant, Essential, Expert models x43, x44,
PS/Valuepoint all models except Cxx models
4MB 96F9290.....$177
16MB 96F9291.....$609
PS/1 Consultant, Essential, Expert models
16MB 96F9291.....$609
PS/2 25/286, 30/286
2MB 30F5360.....$79
PS/2 35SX; LS, 40SX, 50Z, 55SX; LS, 65SX; LS, 70, XStation
2MB 6450604.....$87
PS/2 70-A21; A61; B21; B61, PS/Valuepoint Cxx models
PS/1 Consultant, Essential, Expert models
2MB 6450608.....$95
PS/2 35SX; LS, 40SX, 55SX; LS, 65SX; LS, XStation,
PS/Valuepoint Cxx models
4MB 34F2933 or 87P9977.....$179
PS/2 35SX; LS, 40SX, PS/Valuepoint
8MB 6450129.....$356
PS/2 90 XP, 95 XP, P75 (pairs) 56, 57 (all) PS/1 Pro M2123
2MB 6450902.....$85
PS/2 90 XP, 95 XP, P75 (pairs) 56, 57 (all models)
PS/1 Consultant, Essential, Expert models, PS/1 Pro M2123
4MB 6450128.....$169 8MB 6450130.....$356
PS/2 80-111; 311; 121; 321; 081; 161
2MB 6450379.....$49
PS/2 80-A21; A31; A16
4MB 6451060.....$186
Expansion boards for PS/2 80286 based models
4-16MB w/4MB 6450609 (use 72-pin).....$299
Expansion boards for PS/2 80386 based models
2-14MB w/2MB 34F3077.....$205
4-16MB w/4MB 34F3011.....$299

DESKPRO

DeskPro 386-20; 25, 385-20e, 25e
1MB 113131-001.....$62 4MB 113132-001.....$167
DeskPro 386s/16
4MB 112534-001.....$194
4MB brd 113654-001.....$287
DeskPro 3/25i; 33i, 4/25iS; 33i; 66i, 286N; 386N; SX/20; 20N,
SystemPro LT and M Series
4MB 118690-001.....$153
8MB 118877-001.....$356
ProSignia PC Server 486/33; DX2/66
16MB 149320-001.....$610
32MB 149147-001.....$1152
DeskPro 386-33, 486-33, SystemPro and SystemPro E series
2MB 115144-001.....$109
8MB 116561-001.....$376

NEC

Image 425, 433, 466
4MB 410-12002.....$147 16MB 410-12003.....$556
Ready 425, 433
4MB n/a.....$147 16MB n/a.....$556
PowerMate 386/33i; Express Te, e models
4MB OP410-6205.....$176 16MB OP410-6206.....$610
PowerMate SX Plus
2MB Board n/a.....$163 4MB Board n/a.....$278
PowerMate SX/20
2MB Upgrade OP-410-8101.....$151
2MB Board OP-410-8102+8103.....$171
PowerMate 386/20; 25
2MB APC-H655.....$219 8MB APC-H656.....$559
PowerMate 386/33E, 486/25E
2MB OP-410-5101.....$171

FSI STOCKS CACHE CHIPS FOR ALL SYSTEMS!

STANDARD SIMMS

Easy UPGRADES

30-PIN	72-PIN
1 x 3-70ns (3-chip/1MB) .$35.50	512 x 36-70ns (2MB).....$92
1 x 9-70ns (1MB).....$37	1 x 36-70ns (4MB).....$140
4 x 9-70ns (4MB).....$124	2 x 36-70ns (8MB).....$294
16 x 9-70ns (16MB).....$568	4 x 36-70ns (16MB).....$548

First Source International Always Includes Installation Instructions! (on standard simms)

LASER PRINTER MEMORY

IBM THINKPAD 700 SERIES ONLY! $339 8MB Module *While supplies last

Canon LBP-4
1MB n/a.....$109 2MB n/a.....$159
Canon LBP-811, IIR, IIT
2MB S63-1880.....$119
Epson ActionLaser 1000, 1500
512K n/a.....$35 2MB n/a.....$99
Epson ActionLaser 1100
2MB n/a.....$105 4MB n/a.....$159
Epson ActionLaser 1600
4MB n/a.....$159 16MB n/a.....$609
HP LaserJet 4L
1MB C2024A.....$48
HP LaserJet IIP, III, IIIP, IIID
2MB 33475B.....$95 4MB 33477B.....$169
HP LaserJet II, IID
2MB 33444B.....$95 4MB 33445B.....$169
HP LaserJet IIIsi, 4, 4M, 4Si, 4SiMX, XL300, DeskJet 1200c
1MB C2063A.....$48 2MB C2064A.....$94
4MB C2065A.....$174 8MB C2066A.....$339
HP LaserJet 4P, 4MP, Color LaserJet
2MB C3131A.....$95 4MB C3132A.....$179
HP DeskJet 500, 500C, 520, 520C, 550C, 560, 560C
256K 22707B.....$40
HP DesignJet 5P, 5MP
4MB C3132A.....$170 8MB C3133A.....$329
IBM/Lexmark Laser 4019 (all models)
2MB 1038675.....$107 3.5MB 1039137.....$167
IBM/Lexmark Laser 4029 (all models)
2MB 1183334.....$87 4MB 1183335.....$157
IBM/Lexmark Laser 4039, 4079 (all models)
4MB 1328363.....$157 8MB 1328365.....$319
OkiLaser 400
1MB 70014701.....$69 2MB n/a.....$97
OkiLaser 400e, 410e
2MB n/a.....$117 4MB n/a.....$197
OkiLaser 830, 830 Plus, 840
2MB n/a.....$124 4MB n/a.....$209
Panasonic LaserPartner 4400, 5400
2MB KX-PEM1.....$110 4MB KX-PEM2.....$204
Panasonic LaserPartner 4410, 4430
2MB KX-P444.....$115 4MB n/a.....$196
Panasonic LaserPartner 4450i, 4420
2MB KX-P441.....$116 4MB n/a.....$187

LAPTOP & NOTEBOOK MEMORY

AST

Ascentia 800N, 810N
4MB.....$189
8MB.....$359
16MB.....$699
Ascentia 900N, 910N Special
4MB.....$192
8MB.....$359
Ascentia 950N
16MB.....$699
16MB.....$424
16MB.....$739

COMPAQ

Compaq Elite
4MB.....$189
8MB.....$359
16MB.....$699
Contura 410
4MB.....$185
8MB.....$359
16MB.....$699
Contura 4/25
4MB.....$179
8MB.....$339
16MB.....$659
Contura Aero
4MB.....$185
8MB.....$329
16MB.....$659

Digital

Hi-Note
4MB.....$179
8MB.....$349
16MB.....$619
Hi-Note Ultra
4MB.....$179
8MB.....$349
16MB.....$619

IBM

ThinkPad 360
4MB.....$189
8MB.....$359
16MB.....$599
ThinkPad 701
32MB.....$1,379
4MB.....$189
8MB.....$379
16MB.....$659
ThinkPad 730
8MB.....$359
ThinkPad Power 820
MB.....CALL
ThinkPad Power 850
MB.....CALL
ThinkPad 755
4MB.....$199
8MB.....$389
16MB.....$679
32MB.....$1,379

ThinkPad 700, 720 and CL/75X Special
4MB.....$199
8MB.....$339
16MB.....$669
ThinkPad 710T
32MB.....$1399
4MB.....$179
N51 Notebook
8MB.....$315
4MB.....$179

WHY ADD MORE MEMORY?

"Upgrade to 16MB of memory– it is worth the investment" – Windows Sources Magazine, April 1995

"Memory has a bigger impact on Windous 95's performance than any other single component. If you don't have at least 16MB of RAM, prepare to upgrade." – Windows Sources Magazine, April 1995

NEC

Versa 2000
4MB.....$189
8MB.....$369
16MB.....$639
Versa S
4MB.....$179
8MB.....$359
16MB.....$619
Versa V, M, P
4MB.....$189
8MB.....$359
12MB.....$599
16MB.....$619
32MB.....$1,439

Texas Instruments

TravelMate 4000M, 4000E
4MB.....$189
16MB.....$799
TravelMate 5000
8MB.....$499
16MB.....$899

Toshiba

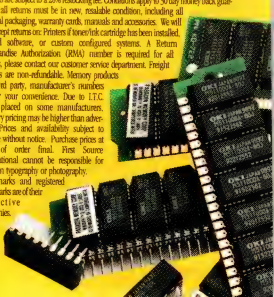
T2100, T2110, T2130, T2150
4MB.....$172
T2155, T2105
8MB.....$335
16MB.....$679
24MB.....$999
T1900, T4500, T4600,
4MB (3.3 V).....$189
T4700, T4800, T4850, T4900
8MB (3.3 V).....$359
16MB (3.3 V).....$699
T3400, T3600 Special
32MB.....$1,379
4MB.....$189
8MB.....$349
16MB.....$679
T610 Portege, T400
8MB.....$541
T3300SL Special
16MB.....$917
32MB.....$1,735
4MB.....$165
8MB.....$389
T4400, T6400 (all models)
4MB.....$179
8MB.....$339
16MB.....$675
T5400, T5200C, T8500
2MB.....$87
8MB.....$347

Zenith

Z-Note Flex
4MB.....$179
8MB.....$439
16MB.....$599
Z-Star
4MB.....$199
16MB.....$699

CALL FOR ANY MEMORY UPGRADE NOT LISTED
We stock memory upgrades for thousands of computers & printers

TERMS & CONDITIONS: Credit card orders shipped only to your verified billing address. Returns are subject to a 20% restocking fee. Conditions apply to 30 day money back guarantee, all returns must be in new, resalable condition, including all original packaging, warranty cards, manuals and accessories. We will not accept returns on: Printers if toner/ink cartridge has been installed, opened software, or custom configured systems. A Return Merchandise Authorization (RMA) number is required for all returns, please contact our customer service department. Freight charges are non-refundable. Memory products are third party, manufacturer's numbers are for your convenience. Due to LTC tariffs placed on some manufacturers, memory pricing may be higher than advertised. Prices and availability subject to change without notice. Purchase prices at time of order final. First Source International cannot be responsible for errors in typography or photography. Trademarks and registered trademarks are of their respective companies.



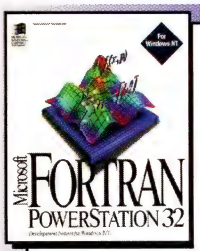
Call the Upgrade Experts

ORDER TODAY! 800-652-9866

Circle 156 on Inquiry Card (RESELLERS: 157).

SciTech SOFTWARE FOR SCIENCE

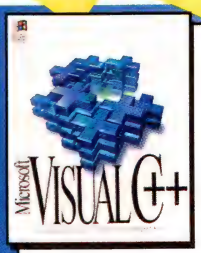
Best Sellers at great prices



MICROSOFT® FORTRAN POWERSTATION

Develop & run Fortran programs of virtually any size & complexity with Microsoft FORTRAN PowerStation family of 32-bit development systems! Migrate Fortran code from other platforms with little or no modification! Get unparalleled price/performance! Save time in code development and maintenance using the Windows integrated development environment. Call NOW to order or request a FREE Test Drive Kit!

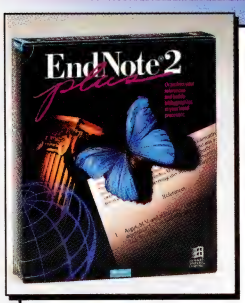
DOS & Windows price $349
Windows NT price $519



MICROSOFT® VISUAL C++

If you program in C or C++ and use MS DOS®, Windows® or Windows NT™, Microsoft Visual C++™ (version 2.0) is THE product to use. Visual C++ features an optimizing compiler and a state-of-the-art Integrated Development Environment that includes a project manager, incremental linking; just in time debugging; books online and a whole lot more! Get outstanding value by enrolling in the subscription program.

Single product price $399
Subscription price $499



EndNote Plus

Bibliography maker that creates bibliographies in your word processor. Comes with a collection of bibliographic styles for more than 240 leading academic journals. Choose from these or create your own. Flexible searching and sorting functions help you to organize your references. EndLink, sold separately, imports references downloaded from online or CD-ROM directly into your EndNote database. *New Windows Version!*

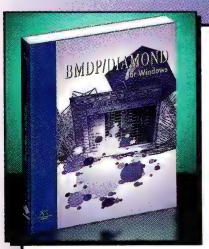
Windows, Mac price $199

ORIGIN

The Ultimate Solution

First technical graphics software developed for the Windows environment. Recognized for being powerful and fast, yet easy-to-use. Features many graph types, point-and-click editing and multiple graphs on a page. Wide selection of math/stat functions including non-linear curve-fitter. Forthcoming version 4.0 is Windows 95 compatible. Free demo disk.

Windows price $399

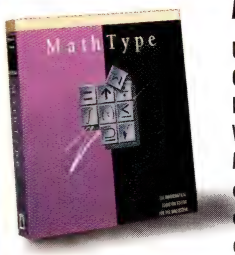


BMDP/DIAMOND

The Multi-Faceted Visualization Tool

Unlike statistics programs that overwhelm you with numeric output that is often difficult to interpret, BMDP/DIAMOND gives you quick insight into your data. With it's incisive, multi-dimensional graphics and powerful analytic tools, you can quickly explore and manipulate your data. Although developed as a stand-alone program, BMDP/DIAMOND complements any software that works with data, including spreadsheets, databases, and statistical software.

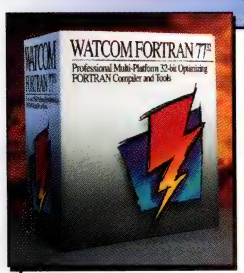
Windows, OS/2 price $395
UNIX price $695



MathType

Upgrade your Equation Editor to MathType. Get the full-featured version of the Equation Editor that comes with Microsoft Word and many other Windows and Macintosh applications. MathType is as easy to use as Equation Editor and you get a lot more features to help you work faster and produce better looking documents.

Windows, Mac price $129
Upgrade from Equation Editor $89

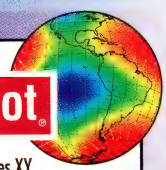


WATCOM

Watcom FORTRAN 77 delivers a comprehensive 16- and 32-bit FORTRAN development system for extended DOS, Windows NT, Windows 95 and OS/2 Warp. Comprehensive language support with FORTRAN 90, DEC VAX & IBM VS extensions eases porting of existing applications. Features: mixed language application development support with Watcom C/C++, new graphical integrated development environment, debugger, browser, profiler, and much more.

Windows 32-bit price $399

TECPLOT



Interactive, menu-driven data visualization and plotting program for engineers and scientists that is advanced yet easy to use. Integrates XY plotting and 2D/3D plotting capabilities. Creates and combines meshes, vector fields, contours, color flooded contours, scatterplots and light source shaded surfaces. Handles multiple, non rectangular data structures and general 3D surfaces. Optional 3DV module adds volumetric plotting. Selected Best Visualization Software by SC&A in 1994. PostScript output.

DOS price $595
UNIX price $1669

Circle 165 on Inquiry Card.

TO ORDER OR FOR MORE INFORMATION CALL

1.800.622.3345

ASK FOR OUR FREE 100-PAGE CATALOG WITH OVER 1,850 PRODUCTS!

SciTech

Circle 177 on Inquiry Card.

•15" & 17" large screen Monitor Ergonomic layout of control panel with intelligent microprocessor digital control
•Innovative options include a multimedia base designed to fit all PC monitor

A Special Choice *for* Multimedia Application

ACTION provides a full range of monitors to choose from. A special recommendation is the 17" home computer monitor with a large screen at reasonable price. For more information, call us today.

ACTION ELECTRONICS CO., LTD.
Head office
Action Electronics Co., Ltd.
198, Chung Yuan Rd., Chung Li Industrial Zone,
Tao-yuan, Taiwan, R.O.C.
Tel.886-3-451-5494 • Fax.886-3-452-0697
Taipei Sales Office Tel.886-596-5955 • Fax.886-2-5928138
U.S.A. Office
Action Computer Technology Inc. Tel.909-444-1300 • Fax.909-444-1308
European Office
Axion Technology GmbH Tel.49-2166-9527-0 • Fax.49-2166-9527-27

FTZ MPR II CE

COMDEX / Fall '95
NOVEMBER 13-17,1995
LAS VEGAS, NEVADA USA
Hall:SECC, .Booth nos:S3526G

Lose 500 pounds in 10 minutes

with a Rose keyboard monitor switch

Call today for free catalog
◆ Print servers
◆ Data switches
◆ Keyboard/video control
800-333-9343

Streamline your computer room by reducing excess equipment. Access up to 256 CPU's from a single keyboard, monitor, and mouse. ServeView is our best-selling switch, has every feature you can imagine, and installs in minutes. Compare price, features, performance, quality, and support and you'll find Rose can't be beat.

P.O. Box 742571 ◆ Houston, Texas 77274
TEL 713/933-7673 ◆ FAX 713/933-0044

Call us to discuss your application or to receive your free information kit.

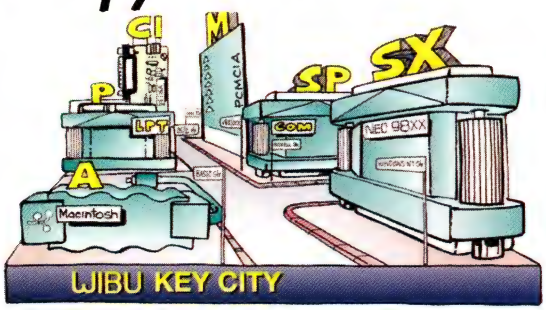
ROSE ELECTRONICS

Circle 160 on Inquiry Card (RESELLERS: 161).

COMDEX®/Fall '95
See us at booth S4077 Sands Expo and Convention

NEW

Copy Protection.....



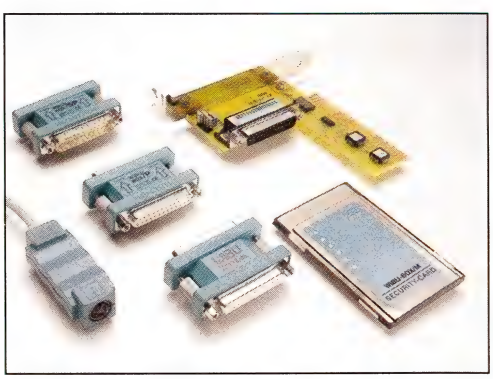
- ✔ WIBU-KEY – Secure against systematic "crackers"!
- ✔ WIBU®-BOX for LPT, COM, ADB, as card for (E)ISA slots and as PC-Card (PCMCIA Type II)
- ✔ WIBU-BOX is smallest ASIC based dongle!
- ✔ Protection for DOS, Windows and networks without requiring source code modification
- ✔ Windows™, Windows™95+NT, Mac™OS, OS/2®, Novell
- ✔ CD-ROM Install-Shield

Call now: 800-986-6578

WIBU-KEY

The most complete palette of copy protection hardware

Order your evaluation package today!



yes It runs with NetWare

Mac OS

Available and ready

PC Card™

MICROSOFT WINDOWS COMPATIBLE

WIBU-KEY

High Quality in Software Protection

WIBU SYSTEMS

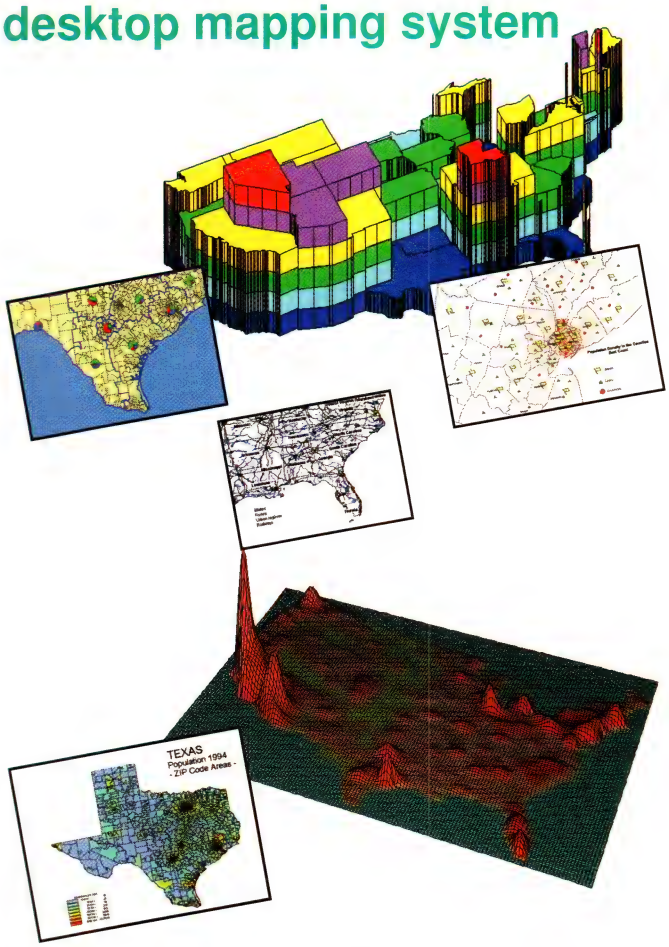
WIBU-SYSTEMS GmbH
Ruepprurrer Strasse 54
D-76137 Karlsruhe, Germany
Phone: +49-721-93172-0
FAX: +49-721-93172-22
CIS: 100142,1674

EUROPEAN SOFTWARE CONNECTION

1617 St. Andrews Drive, Lawrence, KS 66047
Phone: (913) 832-2070, FAX: (913) 832-8787
Techn.Support:(913) 832-1623, CIS: 71141,3624

Circle 168 on Inquiry Card.

See your business data in a minute...
...with RegioGraph, the desktop mapping system



The powerful GIS technology for business is used in RegioGraph for professional presentation and reports, regional analysis, site selection, sales district planning, market delineation and controlling.

Functions

Thematic mapping and shading; 2-D, 3-D pie charts, bar graphs; dot density maps; scaled symbol maps; 3-D prism and contour lines; portfolio technique: presentation of cross tables in maps; easy creation of sales territories; fast aggregation of maps and data; spatial selection and data filter in maps and data; geocoding of pointfiles (customers); unlimited number of layers; multimedia layer; ODBC/OLE; interface to SPSS; import capability of different graphic formats; digitizing module; high quality, scalable output.

MACON

MACON GmbH
Schoenbornstrasse 21
D-68753 Waghaeusel, Germany
Phone:+49-7254-983-0
FAX: +49-7254-983-290

Circle 169 on Inquiry Card.

Companies from Baden-Württemberg, Germany together at COMDEX/Fall'95

Kleinmann GmbH
Am Trieb 13, D-72820 Sonnenbuehl, Germany
Phone: +49-7128-9292-0, FAX +49-7128-9292-92

Computer Cleaning Products
Not for Endusers. Exclusive with private Label.

Circle 170 on Inquiry Card.

17" MONITOR FOR - $469

PC MALL
(800) 555-6255
Tiger Direct (FL)
(800) 888-4437
USA Flex (IL)
(800) 477-8323

Free Software!
For a limited time, buy a Tympani & receive presentation software, ($99 Value) FREE!

The Tympani - More Bang For Your Monitor Buck!

The Orchestra Diva is singing again. This time, it's about our new 17" Tympani monitor. Now, for $469, you can have a 17" screen, with two-thirds more Windows screen area than a 15" screen. Get a bigger, better and brighter image for larger text and more vivid multi-media impact.

All that extra screen area, with a maximum non-interlaced resolution of 1024x768, for an estimated street price of only $469!

More Screen For Your Buck

Even with a $469 price tag, the Tympani offers pincushioning control and Energy Star compliance, with DPMS power management.

For more features and performance, look to Orchestra's newest 15" and 17" displays, the French Horn II and the Tuba II.

	Tympani	Tuba II	French Horn II
Dot Pitch (mm)	**0.42**	0.28	0.28
Maximum Resolution (Non-interlaced)	**1024x768**	1600x1280	1280x1024
Trapezoidal Control	**NO**	YES	YES
Tilt/Rotation Control	**NO**	YES	YES
Pincushion Control	**YES**	YES	YES
Color Balance Control	**NO**	YES	YES
Color Temp. Control	**NO**	YES	YES
Microprocessor Controls	**NO**	YES	YES
On-screen Controls	**NO**	YES	YES
Estimated Street Price	**$469**	$699	$499

You're In Control With Advanced On-Screen Display

The French Horn II and Tuba II support high refresh rates and have advanced On-Screen Display controls for adjusting image geometry and color. Adjust the tilt/rotation, pincushion/barreling and trapeziod aspects, so your image is sharp, square and stable, just the way you like it.

Moreover, color balancing allows adjustment of Red, Green and Blue, so you can match your screen color to your printer output, or maybe just your mood.

Call us at (800) 237-9988 from 8:30am to 5:30pm, PST and ask a product specialist about the full line of Orchestra 14", 15" and 17" displays as well as the Tempo Series of PCI and Vesa Local Bus video adaptors.

For all your monitor needs, Orchestra has a model to fit your computing style.

For more information, or to find a dealer nearest you, call today. The Diva is singing for Orchestra; let Orchestra perform for you.

(800) 237-9988

© 1995 Orchestra MultiSystems, Inc. All trade names are trademarks of their respective companies.

Orchestra MultiSystems, Inc.
Technology in Concert

Circle 252 on Inquiry Card (RESELLERS: 253).

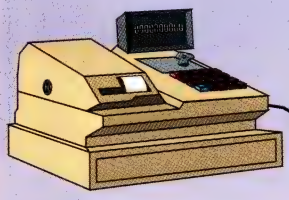
MultYCon
LIGHTSTONE
>NetPC<

The PC Revolution

Cheaper and
faster data access
than server based LANs!

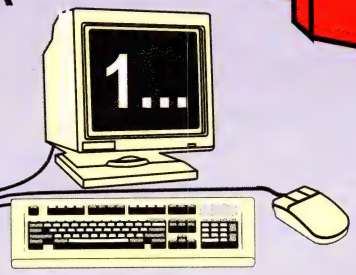
Runs MS-/IBM-DOS and
Windows 3.1x MU/MT preemptively!

Replaces LANs of up to 6 workstations!

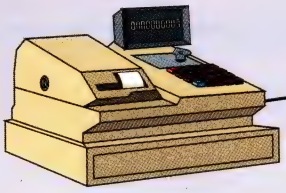


8,000
units sold!

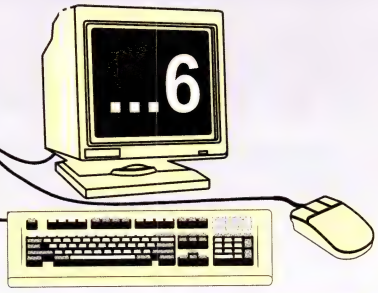
ISA or PCI
SVGA



**Up to
12 parallel printers &
32 serial devices!**



One PC serves up to 6 workplaces!
DOS and Windows app's in text
and graphic modes!



- The worldwide unique and US patented single PC based multiuser solution with LAN functionality (file/record locking)
- No maintainance costs and learning curve
- Users only see and work with DOS/Windows
- The only solution using ISA or PCI standard SVGA or MultiVGA cards plugged in parallel
- Expandable to large networks with only few PCs
- The ideal multi-workplace front end for C/S environments
- Full featured device sharing of LPTs, COMs, hardlocks, NICs!

NetBIOS and
Novell 3.x/4.x
compatible!

Your exclusive distributor in North and South America:
ELSNER Technologies Company
5020 Mark IV Parkway
Fort Worth 76106 Texas
Call now: 1-800-243-2228

See us at:
Networld & Interop, Atlanta
Booth # 7364
Comdex/Fall, Las Vegas
Booth # A4333, # S3050/19
Networks Expo, Boston '96
Booth # 300

LIGHTSTONE Multiuser Systems GmbH
Call your national distributor:
NL: +31-77-736204 PL: +48-58-562595 H: +36-75-312861
CH: +41-61-9769292 TAN: +255-51-28316 ROC: +886-2-963-0706
KEN: +254-11-227834 CR: +42-48-487021/+42-38-31291
Int'l Fax: +49-5643-980122

Referred trademarks are property of their owners.

International distributors and resellers are welcome!

Circle 181 on Inquiry Card (RESELLERS: 182).

WE WILL TRY TO MATCH OR BEAT ANY ADVERTISED PRICE. CALL FOR LATEST PRICING!!

WE ACCEPT PO'S FROM QUALIFIED FIRMS

30 DAY MONEY BACK GUARANTEE

MEMORY

LIFETIME WARRANTY

SECURITY WILL CALL WINDOW NOW OPEN! NO SURCHARGE FOR MC, VISA AE & DISCOVER

CACHE MEMORY

	12NS	15NS	20NS	25NS
8Kx8	–	6.50	6.00	5.50
32Kx8	14.00	9.00	8.00	7.00
32Kx8 (3.3V)	–	14.00	9.50	–
64Kx1	–	11.00	9.00	8.00
64Kx4	–	11.00	9.00	8.00
64Kx8	–	15.00 (5V)	19.00 (3.3V)	–
16Kx4	–	8.00	7.00	6.00
128Kx8	–	29.50	26.00	24.00

Individual D-RAM Chips

MEMORY FOR IBM & APPLE	50NS	60NS	70NS	80NS	100NS
1Megx1	–	6.95	6.45	5.95	4.95
1Megx4	–	49.00	39.00	38.00	–
1Megx4 (Zip Pk)	–	24.00	22.00	21.00	–
256x4(Page Dip)	–	7.25	6.75	6.50	5.95
256 (4/Static Dip)	–	–	9.95	–	–
256x4(Page Zip)	–	9.25	9.00	8.95	–
256x4(Video Zip)	–	–	12.95	11.95	9.95
256x8(SOJ)	–	19.00	18.00	–	–
256 x1	–	3.25	2.95	2.75	2.25
64x4	–	–	–	3.75	–
64x1	–	–	–	–	2.00
256x16 SOJ	–	–	29.00	–	–
256x16 Video Zip	–	49.00	39.00	–	–

INTEL Math Chips

8087	39.00
8087-2	45.00
8087-1	79.00
80287-XL	39.00
80387-16 DX	39.00
80387-20 DX	44.00
80387-DX (Does All)	39.00
80487-SX (Does All)	199.00
Intel SX (Does All)	69.00
Intel SL Mobil	69.00
Intel 16SX	29.00
Intel 20SX	29.00

Lowest price on Intel overdrive chips

CYRIX DRx² 386 to 486 Upgrade
Clock Doubler

CX486 DRx²-25/50.....219.00 CX486 DRx²-33/66.....229.00 CX486 SRX² 25/50.....229.00

SIMM MODULES (Add $5.00 for SIPP)

	40NS	50NS	60NS	70NS	80NS	100NS
256 x 9	–	–	–	10.00	9.00	8.00
1Meg x 9 (3 chip)	–	48.00	45.00	42.00	40.00	–
1Meg x 9 (9 chip)	–	49.00	46.00	43.00	41.00	39.00
4Meg x 9	–	–	154.00	149.00	139.00	–
16Meg x 9 (9 chip)	–	–	–	669.00	–	–

72 PIN SIMMS (EISA), EDO

256 x 36 1 mg	–	–	–	69.00	59.00	–
512 x 36 2 mg	–	–	–	89.00	79.00	–
1 meg x 36 4 mg	–	–	189.00	179.00	179.00	–
2 x 36 8 mg	–	–	379.00	364.00	364.00	–
4 x 36 16 mg	–	–	599.00	549.00	549.00	–
8 x 36 32 mg	–	–	1189.00	1149.00	1149.00	–
16 x 36 64 mg	–	–	2799.00	2745.00	2745.00	–
1 X 32 4 mg	–	–	199.00	164.00	164.00	–
2 x 32 8 mg	–	–	349.00	329.00	329.00	–
4 x 32 16 mg	–	–	499.00	479.00	479.00	–
1 x 32 4 mg EDO	–	–	–	189.00	–	–
2 x 32 8 mg EDO	–	–	–	389.00	–	–
4 x 32 16 mg EDO	–	–	–	689.00	–	–
8 x 32 32 mg EDO	–	–	–	1289.00	–	–

CYRIX FASMATH PROCESSOR

Programs executed up to 3X faster • Plug & object code compat. w/Intel

83D87-40MHz – **79.00** 83D87-33MHz – **49.00** 83S87-25SX Ver. – **49.00**

83S87-33SX – **65.00** **PC Week**™ rated #1 over all math chips

5 Year Warranty • "All Downward Compatible"

AST MEMORY

MODEL	AMT. UPGRADED	AST PART #	PRICE
Bravo LC Series, Bravo MT, Bravo MS, MS-L, Advantage Pro DX33, SX25	4Meg	5009787-002	154.00
	8Meg	5009787-003	308.00
	16Meg	5009787-004	539.00
	32Meg	5009787-005	1078.00
Premmia LX P/60, MX4/66d, 4/100T, P/60	8 Meg	5009787-003	320.00
	16 Meg	501340-002	549.00
	32 Meg	5009787-005	958.00
	64 Meg	501959-001	Call
Premmia 4133, 4133S, 4/50d, 4/60d	8 Meg	501159-002	338.00
Premmia SE 4/33, 4/66d, P/60	16 Meg	501159-003	658.00
Premmia MTE 4/33, 4/66d, P/60	32 Meg	501159-004	1149.00
Manhattan G, V Series Server	64 Meg	501159-005	2298.00
Power Premium 3/33, 4/33, 4/33S, 4/50d, 4/66d	8Meg	5007801-001 } 72 pin	378.00
Premium 486/25, 486/25E, 486/33, 488/33E			
Premium 386/33TE, 486/25TE, 486/33TE			
Prem. II 386/25, 386/33, 486/33, 486 SX/20			
Bravo 486/25, 486/33	2 Meg Kit	5007801-005	118.00
Advantage 486/25, 486/33, 486/33P, 486 SX/20			
Premium SE4/22	8Meg Kit	5007801-001 } 64 pin	378.00
Premium SE 4/50, d, 66d, P/60	1 Meg	5007801-003 }	59.00
Prem. 386/33T, 386 SX16, Prem.II 386SX.20, 386/25	4Meg	5007801-004	189.00
Premmia GX P/90, P/100	8Meg Kit/16MegKit	501565-001/501566-001	378/699
	32Meg Kit/64Meg Kit	501567-001/501568-001	1358/2699
AST Cupid Board	0-32 Meg	500818-001	179.00

AMBRA

Ambra Pentium-60	4/8/16 Meg	175.00/369.00/619.00
Ambra NC 4225L	2/4/8 Meg	109.00/199.00/366.00
Ambra N Series	4/8/12/16 Meg	189.00/349.00/549.00/619.00
Ambra SN Series	4/16 Meg	189.00/639.00
Ambra Sprinta SLC II	2/8 Meg	89.00/319.00
Ambra N-75, N-100	4/8/16	189.00/369.00/619.00

MAGNAVOX

286/386SX-16, 386SX-20, 486SX-20 & 386-33 *all are 72PIN SIMM:*

1MEG – 59.00 4MEG – 169.00 8MEG – 349.00 16MEG – 619.00

ZENITH MEMORY MODULES

MODEL	AMT. UPGRADED	MFG. PART #	PRICE
Z386/33, 25, 20, 33E	1Meg	ZA3800ME	59.00
Z386/33, 25, 20, 33E, 486/25E	4Meg	ZA3800MK	169.00
Z386SX	2Meg	Z-605-1 modules	89.00

H.P. COMPATIBLE FONT CARTRIDGE

BAR CODES Bar Code Reader Fonts.....99.00
DESKJET SOLUTION for DkJt 500 & Plus, 92 Fonts. 4.5 pt-30 pt.....99.00
IBM 4019, 4019E, FONT CARTRIDGE 209 Fonts, Turbo Card.....105.00
TURBO 25 Comparable to Pacific Data's 25 CARTRIDGES IN ONE!™, 143 Fonts *(compat. with Epson Action Laser II and all HP Printers)*.....69.00
TURBOSCRIPT™ 109, 109 Scalable Fonts to Any Point Size HP2D, 3, 3D, 3P, 2P, 2P+.....149.00
TURBOSCRIPT™ 109, 109 Scalable Fonts to Any Point Size HP2.....109.00
TAX & FINANCE FOR IBM 4019, 4019E, 4029.....139.00
TAX & FINANCE CARTRIDGE.....84.00
OKI 400, 800 41 fonts, 11 typestyles.....169.00

MEMORY BOARDS
IBM Compatibles & PS/2

BOCA AT PLUS

USES SIMMS

16 BIT MEMORY BD. FOR 286, 386 AT • 0K-8Meg Bd. 4.0 LIM Compat. • New 5 Yr. Warr. Convent., Expnd. & Extnd. Memory • Supports DOS, OS/2, LIM/EMS & EEMS • Versatile Split Memory Addressing • Operates w/CPU Speeds to 33 MHz • Supports Desqview, Multitask operations • *Bd. made by Boca Research, AT plus*

0K – $84.00 2Meg – $159.00 4Meg – $239.00 8Meg – $399.00

BOCA XT 8 BIT BUS

• Expanded memory for XT • Lim 4.0 compat. 0-2Meg • Uses 256x1-100

0-K – **$99.00** 1Meg **$189.00** 2Meg – **$229.00**

IBM P/S2 32BIT EXPANSION BD.

0-16Meg, Ext.-Expnd. Memory Bd. for P/S2 70, 80, 90, Lim 4.0

0Meg **$139.00** 2Meg **$238.00** 4Meg **$319.00** 8Meg **$499.00** 16Meg**$859.00**

PS/2 MCA 0-8MEG EXPANSION BD.

0-8Meg Extended and/or Expanded Memory for all IBM P/S2 Models 50, 50Z, 60, 55SX, 65SX, 16 Bit, 4.0 LIM Compat.

0K – **139.00** 2Meg – **228.00** 4Meg – **308.00** 8Meg – **477.00**

USES 1 X 9 SIMMS BOCA BR MC-80

BATTERIES

★ ★ CALL FOR NOTEBOOK AND LAPTOP BATTERIES ★ ★

IBM PS/1, PS/2 MEMORY MODULES

IBM PART NO.	WORKS WITH MODEL NO.	PRICE
30F5348 (512K)	30-286	37.00
30F5360 (2Meg)	30-286, 25-286, 50 MTHR BD.	104.00
6450375 (1Meg)	80-041	79.00
6450379 (2Meg)	80-111, 311-121, 321, 081, 161	84.00
6451060 (4Meg)	80-A21, A-61, 80-A31, 80-111, 80-311	189.00
6450604/92G7196 (2Meg)	70-061, 661, 121, 502, 55SX, 65SX, P-70	99.00
	55LS, 65LS, X-Station 120 & 130, 35SX, 35LS, 40SX	
6450608 (2Meg)	70-A21, A-61, 9-21, B-61, 35SX, 35LS, 40SX, Val Pt. 325T	90.00
78X8955 (128K)	25	35.00
34F2933 (4Meg)	35SX, 40SX, 55SX, 65SX, 55LS, 65LS	169.00
87F9977/92G7199 (4Meg)	55SX, 55LS, 65SX, 40SX, 35SX, 35LS	179.00
1057035 (512K)	P/S1-286	49.00
92F9935 (2Meg)	P/S1 & P/S1/386SX-2121	109.00
92F9894 (4Meg)	P/S1 & P/S1/386SX, Model-2121	189.00
92G7200 (4Meg)	PSI Expert, Consultant; Willow	169.00
92G7201, 73G3131 (4Meg)	Value Point Performance, PC Server 4/66	169.00
92G7539 (4Meg)	Aptiva 310, 330, 350, 510, 530, 710, 730	164.00
92G7541 (8Meg)	Aptiva 310, 330, 350, 510, 530, 710, 730	309.00
92G7543 (16Meg)	Aptiva 310, 330, 350, 510, 530, 710, 730	559.00
92G7545 (32Meg)	Aptiva 310, 330, 350, 510, 530, 710, 730	1149.00
73G3132/92G7203 (8Meg)	Value Point Performance, PC Server 4/66	349.00
60G1622/92G7204 (16Meg)	Value Point Performance, PC Server 4/66	609.00
92G7205 (32Meg)	Value Point Performance, PC Server 4/66	1239.00
6450902 (2Meg)	56, 57, 57SX,90, 95, P-75, 57SLC	90.00
	Value Point 77 486DX2, 486SX, SVR 85	
6450128/92G7200 (4Meg)	57SX, 90, 95, P-75, 57SLC, 56, 56SLC, P/S1 386SX,	169.00
	Mod-2123, 2133, 2155, Val Pt.77, 486DS2, 486SX, SVR85	
	Value Point 77 486DX2, 486SX, SVR 85	
6450129/92G7428 (8Meg)	35SX, 40SX	349.00
6450130/92G7202 (8Meg)	56, 57, 57SX, 90, 95, P-75, 57SLC	349.00
	Value Point 77 486DX2, 486SX, SVR 85	
6451158/92G7208 (4Meg ecc)	486 35XP, 95X (install in pairs)	199.00
6451159 (8Meg ecc)	486 95XP, 95A (install in pairs)	399.00
92G7209/92G3720 (16Meg ecc)	9595 OPT	719.00

IBM NOTEBOOK & LAPTOP MEMORY

07G1415/07G1420 (4Meg)	Thinkpad 750, C, 700, C, 720, C, CL57SX	189.00
07G1416/07G1421 (8Meg)	Thinkpad 750, C, 700, C, 720, C, CL57SX	359.00
66G0095 (16Meg)	Thinkpad 750, C	629.00
66G0094 (4Meg)	Thinkpad 755, 360, 355, 340, 450	179.00
66G0094 (8Meg)	Thinkpad 755, 360, 355, 340, 450	349.00
66G0095 (16Meg)	Thinkpad 755, 360, 355, 340, 450	619.00
8189098 (4Meg)	Thinkpad 500, 510CS (3.3 volt)	189.00
8189099 (8Meg)	Thinkpad 500, 510CS (3.3 volt)	369.00
79F0999 (2Meg)	LX40, N33SX, PS Note	103.00
79F1000 (4Meg)	LX40, N33SX, PS Note, Tkpd 350, 350c, PS Note 425	189.00
79F1001 (8Meg)	LX40, N33SX, PS Note	349.00
Hard Drive (524Meg, 710 Meg))	Thinkpad 750, 755, 360, 355	829/929
(4Meg/16Meg)	Thinkpad 755 Dimm Modules	199/749
(4Meg/16 Meg w/Adap	Thinkpad 755	299/899
60G0378 (8Meg)	Thinkpad 350, 350c, PS Note 425	339.00
60G0379 (16Meg)	Thinkpad 350, 350c, PS Note 425	569.00
92F8804 (2Meg)	NASSL	109.00
92G7259 (4Meg)	Thinkpad 701C, CS, Butterfly	189.00
92G7261 (8Meg)	Thinkpad 701C, CS, Butterfly	369.00
92G7263 (16Meg)	Thinkpad 701C, CS, Butterfly	549.00
4Meg/8Meg/16Meg (730T only)	Thinkpad 340, 730T	219/359/579
8Meg/16Meg	Thinkpad 820	390/729
4Meg/8Meg/16Meg/32Meg	Thinkpad 850	193/399/719/1439
4Meg/8Meg/16Meg/32Meg	PC300 Pentium	179/339/629/1259

COMPAQ MEMORY MODULES

MODEL	AMT. UPGRADED	CMPQ PART #	PRICE
DeskPro 386/33, 386/33L, 486/25, 486/33L	2Meg Module	115144-001	99.00
486/25, 486/33L	8Meg Module	116561-001	349.00
4 Meg w/ System Pro	32Meg Module	115569-001	1399.00
DeskPro 386/33L, 486/33L	(Exp Bd)	116563-001	279.00
DeskPro 286/33, 386/20	1Meg Module	113131-001	79.00
	4Meg Module	113132-001	199.00
DeskPro 386S-16MHz	1Meg Exp Bd	113633-001	149.00
	4Meg Exp Bd	113634-001	279.00
DeskPro 386/20E	1Meg Exp Bd	113645-001	79.00
DeskPro 386/25E	4Meg Exp Bd	113646-001	199.00
	1Meg Module	112534-001	79.00
	4Meg Module	113133-001	199.00
DeskPro 286N, 386N, 386SX20, all "M" series, sytem LT series, all "I" series	1Meg Module	116888-001	59.00
	2Meg Module	116889-001	89.00
	4Meg Module	116890-001	169.00
	8Meg Module	128677-001	347.00
M Series Exp Bd	0-64Meg	129160-001	189.00
DeskPro 386/16	1Meg Kit	108071-001	99.00
	4Meg Kit	108072-001	299.00
	1-2Meg Exp Bd	108069-001	239.00
	4-8Meg Exp Bd	108070-001	437.00
DeskPro 286 ALL OF	512K Kit	113012-001	49.00
DeskPro 5/90, 5/66M, 5/66M THESE	8Meg Kit	149911-001	376.00
Prosignia 200 MACHINES	16Meg Kit	149946-001	676.00
Proliant 100 5/60 USE	32Meg Kit	149912-001	1420.00
Proliant 2000 4/30, 5/66 THESE	64Meg Kit	149913-001	2476.00
Proliant 4000 4/50, 5/66 MODULES	128Meg Kit	149914-001	5076.00
Prolinea 386 3/25S, 3/25CS	2Meg	141738-001	90.00
	8Meg	141742-001	298.00
Prolinea 486 4/25S, 4/33, 4/50, 4/66, CDS	2Meg	141683-001	95.00
Enhanced Prolinea, Prosario series	4Meg	141684-001	169.00
	8Meg	141685-001	339.00
Prosignia PC Server, 486/33, 486 DX2/66	8Meg	141685-001	339.00
	16Meg	149329-001	629.00
	32Meg	149147-001	1289.00

COMPAQ LAPTOPS & NOTEBOOKS

LTE/286	4Meg Bd	117081-003	179.00
LTE/386S/20	4Meg Module	121125-002	219.00
LTE LITE/20, 25, 25C	4Meg Module	129769-002	219.00
LTE LITE/20, 25, 25C	8Meg Module	129769-003	429.00
LTE LITE/20, 25, 25C	16Meg Module	129769-004	669.00
LTE LITE 4250/33C/25E/25L	4Meg Module	142337-002	189.00
LTE LITE 4250/33C/25E/25L	8Meg Module	142337-003	349.00
LTE LITE 4250/33C/25E/25L	16Meg Module	142337-004	619.00
SLT/286	4Meg Module	110237-001	199.00
SLT/386	2Meg Module	118304-001	109.00
SLT/386	4Meg Module	118305-001	219.00
Concerto, LTE Elite	4Meg	144790-001	189.00
	8Meg	144790-002	353.00
	16Meg	144790-003	619.00
Contura 320, 325	2Meg	139497-001	99.00
	4Meg	139498-001	189.00
	8Meg	139499-001	339.00
Contura 400, 410	4Meg/8Meg/16Meg		189/369/619
Contura 420, 430	4Meg/8Meg/16Meg/20Meg		219/379/719/879
Contura 4/25, 4/25C, 4/25CX	4Meg	146520-001	189.00
	8Meg	146521-001	349.00
	16Meg	146531-001	619.00
Aero 4/25, 4/33	4Meg	190532-001	184.00
	8Meg	190597-001	349.00

NO SURCHARGE FOR MASTERCARD, AMEX, VISA OR DISCOVER. PURCHASE ORDERS ACCEPTED FROM FORTUNE 2000, GOVERNMENT & INSTITUTIONS. California orders add 8.25%sales tax. Returned orders or ordered wrong parts are subject to a 20% restocking fee. (Memory chips not installed in boards.) We accept International orders shipped via UPS Air, APO, FPO orders welcome. Customers are expected to pay customs and "other" charges if shipped Int'l. All credit card charges verified for fraudulent use. SORRY, NO REFUNDS AFTER 30 DAYS – EXCHANGES ONLY. If you receive defective merchandise we exchange only—no refunds. We accept MC, VISA, Discover, AE, prepaid orders, purchase orders, wire transfer, COD (cashiers check) orders, cash & cashiers checks. Orders shipped by UPS, FEDX must be signed for.

• ALL MANFACTURER PART #'S ARE FOR REFERENCE ONLY • MINIMUM ORDER $40.00 • NO REFUNDS ON SHIPPING.

CUSTOMER SERVICE & TECHNICAL: OPEN M–F, 9–4 PST

All products brand new & guaranteed • We buy excess inventory

Trademarks are registered with their respective companies.

L.A. TRADE

22825 Lockness Avenue • Torrance, CA 90501

TOSHIBA LAPTOP MEMORY

MODEL	AMT. UPGRADED	MANU. PART #	PRICE
T2000SXE/2200SX/T1800, 1850, C	2Meg	PA-P2000U	89.00
T2000SXE/2200SX/T1800, 1850, C	4Meg	PA-P2001U	189.00
T2000SXE/2200SX/T1800, 1850, C	8Meg	PA-P2002U	359.00
T*1100, 2105, 2150	4Meg/8Meg		189/379
T*1100, 2105, 2150	16Meg/24Meg		729/1134
T4400SX, SXC T6400, T6600	4Meg	PA-P2004U	189.00
T4400SX, SXC T6400, T6600	8Meg	PA-P2005U	379.00
T4400SX, SXC T6400, T6600	16Meg	PA-P2010U	699.00
T4500, T 14600 T4700, T1900, C, T1910, T1950 (3.3 v)	4Meg	PA-P2012U	189.00
T4500, T 14600 T4700, T1900, C, T1910, T1950 (3.3 v)	8Meg	PA-P2013U	349.00
T4500, T 14600 T4700, T1900, C, T1910, T1950 (3.3 v)	16Meg	PA-P2014U	652.00
T4700, 4800, 4850 (Hard Drive)	524Meg/710Meg		799/1098
T3400CT, T2400, T3600	4Meg	PP-PA2019U	189.00
T3400CT, T2400, T3600	8Meg	PA-P2020U	369.00
T3400CT, T2400, T3600	16Meg	PA-P2021U	619.00
T3400CT	32Meg		1549.00
T3100SX	2Meg	PC15-PA8308U	109.00
T3100SX	4Meg	PC15-PA8310U	189.00
T3200	2Meg	PC8-PA7137U	170.00
T3200SX	2Meg	PC12-PA8307U	119.00
T3200SX	4Meg	PC12-PA8309	199.00
T5200/T8500	2Meg	PC10-PA8304U	114.00
T5200/T8500	8Meg	PC10-PA8313U	419.00
T600, 610, CT	4Meg/8Meg/16Meg		Call

NOTEBOOK, LAPTOP MEMORY

MODEL	AMT. UPGRADED	MANU. PART #	PRICE
ACER 730, 735C, 760, 780	2Meg/4Meg/8Meg		109/179/369
ACER 763, 765, 782, 784, 786, 787,	4Meg/8Meg/16Meg		179/379/729
ACER 750	4Meg/8Meg/16Meg		189/379/629
ALR Venture	4Meg	12407980	249.00
Altima Virage	4 Meg/ 16 Meg		199/679
Altima Virage II	4Meg/8Meg/16Meg		199/369/622
AST Advantage Quantum 4066D, 6066D, 8066D	8Meg/16Meg/32Meg/64Meg		189/469/999/1262
AST Ascentia 900N, 800N	4Meg/8Meg/16Meg		189/379/629
AST Ascentia 950	8Meg/16Meg		419/759
AST Bravo & Explorer	4Meg/8Meg/16Meg	501255-001, -002	189/379/629
AST Bravo MS-I, P90	8Meg/16Meg/32Meg/64Meg		379/759/1249/2599
AST Notebook Prem Exec 386SX/20/25/SL,	4Meg	500814-003	199.00
AST Power Exec 3/25C, 425EL, 425SL	4Meg/16Meg	501166-001, -003	199/629
AST Power Exec 4/33SL	4Meg/16Meg	501318-001,002	194/679
AT&T Globalyst 200	4Meg/8Meg/16Meg		199/389/679
AT&T Safari NSX/20	4Meg	PEC 37651	259.00
Austin DX4, DX2, SLC, SX Series	4Meg/16Meg		199/699
Bondwell B310, Plus	1Meg	23050-09100	69.00
Bondwell B310V, SX	1Meg/4Meg		109/229
Canon Innova Book 150	4Meg/16Meg		199/769
Canon Innova Book 200LS	4Meg/8Meg/16Meg/24Meg		189/379/639/Call
Canon Innova 486	2Meg/8Meg/16Meg		109/209/449
Canon Innova 486-10	4Meg/16Meg		199/639
Canon Notejet 486	4Meg/8Meg		199/389
Canon Notejet DX4/75	4Meg/8Meg/16Meg		209/379/679
Chaplet 486	4Meg/16Meg		199/679
Chicony N95	4Meg/16Meg		199/679
Compuadd 425TX Notebook	4Meg/16Meg		199/679
DEC HiNote	4Meg/8Meg/16Meg		199/379/669
Dell Latitude M, MC, MCX	4Meg/8Meg/16Meg		189/379/639
Dell Latitude XP, 475, 4100, 4100CX	4Meg/16Meg		199/639
Dell Latitude 486, 425, 433C, 433CX, 450, 450CX	4Meg/16 Meg		199/679
DTK 4710/P Notebook	4Meg/8Meg/16Meg		189/369/619
Epson ActionNote 650, 650c	4Meg/8Meg/16Meg		209/399/659
Epson ActionNote 700, 700c, 700cx	4Meg/8Meg/16Meg		199/539
Epson ActionNote 880, 866c	4Meg/8Meg/16Meg/20Meg		Call/389/669/Call
Epson ActionNote 4000 Notebook	6Meg		279
Epson ActionNote 4LC/25, 4LC/33, 4SLC/2-50	2Meg/8Meg		119/279
Everex Tempo LX, LX20, Carrier	2Meg	PCA 00053-0001	109.00
Gateway 2000 Colorbook 425	4Meg/16Meg		199/619
Gateway 2000 Nomad 425 DXL/SXL	4Meg/16Meg		199/769
Gateway 2000 486 Handbook or Liberty	4Meg/16Meg		199/679
HP Omnibook 300, 480, 425	2Meg/4Meg		199/369
HP Omnibook 530, 600	4Meg/8Meg/12Meg		189/379/549
HP Omnibook 4000	4Meg/8Meg/16Meg		199/379/649
Leading Edge Avina	4Meg/16Meg		199/539
Lexmark SE10	4Meg/8Meg		209/399
Magnavox Megalis	1Meg/4Meg	286, 386SX	159/199
Midwest Micro Elite SX-25, SX33, DX2-50, DX2-66	4Meg/8Meg/16Meg		199/389/629
Midwest Micro Elite Sndx SX33, DX2-50, DX4-75, DX4-100	4Meg/8Meg/16Meg		199/389/629
Midwest Micro Elite Sndx Plus DX-75, DX-90	4Meg/8Meg/16Meg		199/389/629
NOR Safari 3180	4Meg/ 8 Meg		189/369
NEC Prospeed 386	2Meg	PC31-21	119.00
NEC Prospeed 386	8Meg	PC31-22	399.00
NEC Prospeed 286, 386SX-16, 386SX-20	4Meg	PC21-22, PC43-22	199.00
NEC Ultralite Versa E, V	4 Meg/8Meg/16Meg/24Meg	OP4104	183/359/619/799
NEC Versa Removable Hard Drive	540Meg/710Meg/810Meg		859/949/1033
NEC Versa S	4Meg/8Meg/16Meg		189/379/629
NEC Versa 2000C & 2000D	4Meg/8Meg/16Meg		199/379/799
Packard Bell 386SX, 286	1Meg, 4Meg	286, 386SX	109/179
Packard Bell Statesman	2Meg/8Meg		119/369
Panasonic CF170, CF270, CF370	4Meg Module	CF-BA165	59.00
Panasonic CF380, CF480	2Meg/4Meg/6Meg		119/199/309
Panasonic CF-210F, CF-580	4Meg/16Meg		219/619
Panasonic CF-V41	4Meg/8Meg/16Meg/32Meg		219/419/692/1999
Sanyo 1200	2Meg	M8C-NBMEM2	109.00
Sharp 6781, 6881, 6785, 6700, 6800, 6741	2Meg/4Meg		109/199
Sharp 8150, 9650, 8660, 7700, 7760	4Meg/16Meg		199/679
Sharp 8700 Series	4Meg/8Meg/16Meg		199/379/649
Sharp PC310, PC350, 3010 & 3050	4Meg/8Meg/16Meg		209/369/669
TI Travelmate 3000	1Meg	2588034-0001	79.00
TI Travelmate 3000	2Meg	2566996-1	84.00
TI 4000, TI 4000E	4Meg/16Meg		199/768
TI 4000M	4Meg/16Meg		199/768
TI 5000	4Meg/8Meg/16Meg		Call/419/793
Tandy 1510, 2810, 3810	1Meg		49.00
Tandy 2820, 3820, 3830	2Meg/4Meg/8Meg		119/199/309
Twinhead, Atima, Computime, 486SX, DX, Tandy 4860	4Meg/16Meg		199/679
Twinhead, Slimnote 5	4Meg/8Meg/16Meg		199, 379, 649
Ultra 486 TS38	4Meg/8Meg/16Meg		189/369/629
Zeos 386SX Notebook (not the + version)	2Meg		109.00
Zenith Master Sport 386SX	2Meg	ZA-300-1	114.00
Zenith Master Sport SL, SLE, 600, 620, 625NL	2Meg	ZA-4-4	104.00
Zenith Super Sport 286E, 286E SX	2Meg	ZA-180-86	99.00
286E SX	2Meg	ZA-180-64	119.00
SX Alpha/SX Beta	2Meg	ZA-180-86/ZA-180-87	119.00
Zenith Z-Note 425SX/L, LNC, LNP	4/8/16Meg		199/379/619
Zenith Z-Star 4/33	2/8Meg		119/369

PCMCIA VERSION 2.0 (for Palmtop & Subnotebooks)

MODEL	PRICE	MODEL	PRICE
S-RAM Cards 1MEG	159	5250 IBM Emulatin Card	495
S-RAM Cards 2MEG	229	Bus Toaster (High speed SCSI II)	199
28.8/28.8 Data/Fax Modem	259	Wavjammer™ (16 bit stereo sound card)	275
14.400/14.400 Data/Fax Modem	119	Multimedia Combo, Sound/SCSI	499
Readwriter Card (15A Slot)	149	Panasonic KXL-D720 port. CDRom player	339
Lan Ethernet Combo	Call	Type III 130 Mg Hard Drive	499
Lan Ethernet (10 Base T)	169	Type III 170 Mg Hard Drive	599
Lan Ethernet (Coax)	169	Xircom Combo Ethernet + Modem II 28.8 Adapter	549

FLASH MEMORY 2 Meg–109.00 6 Meg–299.00 10Meg–349.00 16Meg–529.00

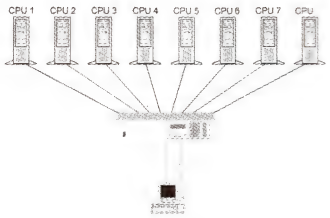
LASER PRINTER MEMORY UPGRADES

AMOUNT UPGRADED	0K Bd	256k	1	2	3	3.5	4	5	6	8	16	32
Brother 630, 831, 641, 645	–	–	89	135	–	–	–	–	–	–	–	–
Canon LBP 430	–	–	69	–	–	–	189	–	–	–	–	–
Canon LBP 860	–	–	–	–	–	–	179	–	–	349	669	1249
Canon LBP4, 4Lite, 4plus	–	–	159	219	–	–	–	–	–	–	–	–
Epson 6000, Action Laser	–	–	–	139	–	–	229	–	–	–	–	–
Epson Action Laser II, 1000, 1600	–	–	69	99	–	–	189	–	–	349	599	–
Epson Action Laser II	–	–	89	–	208	–	–	327	–	305	539	–
Epson 8000, 1800, 4000, 4100, 4300	–	–	89	–	208	–	–	327	–	Call	Call	Call
Epson 1000, 1500, 5000, 5200	–	–	–	***109***	–	–	***219***	–	–	–	–	–
HP 2, 2D+	–	–	–	99	–	–	179	–	–	–	–	–
HP 3, 3D, 3P, 2P 2P+	–	–	–	99	–	–	169	–	–	–	–	–
HP 4, 4M, 4Si, 4SiMX, 4P, 4MP	–	–	–	89	–	–	169	–	–	349	–	–
HP 4L	–	–	59	–	–	–	–	–	–	–	–	–
HP 3Si	–	–	69	–	–	–	169	–	–	349	–	–
HP 4Si	–	–	–	–	89	–	179	–	–	349	–	–
HP 5P	–	–	–	–	89	–	155	–	–	305	539	–
HP Design Jet 600, 650, 200	–	–	–	–	89	–	175	–	–	349	–	–
HP Deskjet 500, 500C, 510, 550,560	–

Examples of Multi-Server-Network-Centers

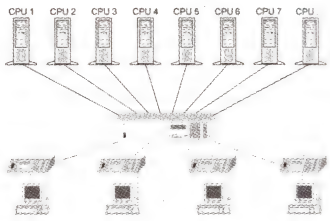
Single access system

- Basic units available for 2*, 4, 8, 12, 16, 24, and 32 CPUs
- Remote control optionally
- distance up to 328 ft (100 m)
- high quality video at high resolution and refresh rate
- mixed use of serial and PS/2 mice within one single unit
- microprocessor-controlled keyboard and mouse emulation for error-free booting



Multi access system

- Basic units available for 8, 16, and 32* CPUs
- access from consoles on up to four locations to many CPUs without interfering each other (real matrix)
- all features of the single access system build in



*) TBA

The only recommended system by CompuServe Inc. and Microsoft C.E.!

ONE FOR ALL

and all on one

1024 CPUs under control using the

MultYcon Console Switching and Management System

Save monitors, keyboards, and mice!
Save administration costs, hardware, office fixtures, energy, and space!

MultYCon

See us at:
Networks Expo, Dallas
Networld & Interop, Atlanta
Systems, Munich (Germany)
Comdex Fall, Las Vegas

Distributors and system integrators worldwide welcome!

North America:
ELSNER Technologies Company
5020 Mark IV Parkway
76106 Fort Worth Texas
Tel.: 1-800-243-2228
Fax: 1-817-626-5330
Mail: CompuServe 75457,1377

International (Germany):
PolyCon Data Systems
Tel.: +49-5204-9134-21
Fax: +49-5204-9134-22
Mail: CompuServe 100020,1571

BEST OF BYTE CeBIT '95 Finalist

LASER INKJET COMPUTER CHECKS

CONTINUOUS FEED CHECKS AND CHECK SAVERS ALSO AVAILABLE

AS LOW AS $24.95

CALL: 1-800-239-4087

FAX ORDERS: 1-800-774-1118
(PLEASE CALL FOR A FAX ORDER FORM)

- ✔ QUICKEN
- ✔ SIMPLY MONEY
- ✔ MICROSOFT MONEY
- ✔ MANY MORE!

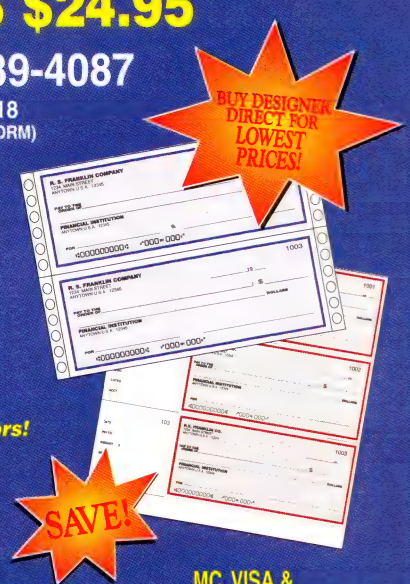
LASER AND CONTINUOUS FEED CHECKS AVAILABLE IN:

- ✔ BUSINESS SIZE
- ✔ BUSINESS SIZE with Voucher
- ✔ WALLET SIZE

Available in Singles and Duplicates.

Choose From 4 Stylish Colors!

Classic Blue | Classic Green | Tan | Prestige



Designer CHECKS

MC, VISA & AMERICAN EXPRESS ACCEPTED

YOUR SATISFACTION 100% SATISFIED GUARANTEED

How to Order

1. Enclose reorder form or voided check from existing check supply, noting any changes.
2. Include deposit slip from existing check supply.
3. Enclose payment check.
4. All orders will be shipped within 7 working days.
5. Complete the order form and mail with items 1,2, & 3 to:

Designer Checks • P.O. Box 13387 • Birmingham, AL 35202

ORDER FORM P10204B5 BYTE

Software: _____ Version: _____

Start my checks with number: _____
(if not given 1001 will be used)

❑ *Singles* ❑ *Duplicates (call for prices)*

Pick ONE Color: ❑ Classic Blue ❑ Tan ❑ Classic Green ❑ Prestige

Laser/Inkjet Checks	250	500	1000	2000	
Business Size	$29.95	$44.95	$59.95	$88.95	$
Business Size w/voucher	$39.95	$57.95	$79.95	$128.95	$
Wallet Size	$24.95	$39.95	$63.95	$89.95	$

Continuous Feed Checks	250	500	1000	2000	
Business Size	$26.95	$39.95	$57.95	$89.95	$
Business Size w/voucher	$29.95	$42.95	$64.95	$99.95	$
Wallet Size	$26.95	$39.95	$59.95	$89.95	$
Shipping & handling					$ 5.00
Shipping & handling by AirBorne add $2.50					$
Subtotal					$
Alabama residents add 8% sales tax					$
TOTAL AMOUNT					$

IBM

THINKPAD 755C	THINKPAD 755CSE	THINKPAD 755CE
DX4/75,4/810mb disk, active color	DX4/100,8/540mb disk, passive color	DX4/100,8/810mb disk, active color
$3699	$3599	$4799

THINKPAD 701C	THINKPAD 755CV	THINKPAD 755CDV
DX4/75,8/540mb disk, active color	DX4/100,8/810mb disk, active color	DX4/100,8/810mb disk, active color
$4450	$5650	$DEAL

THINKPAD 755CD	THINKPAD 755CD
DX4/100,8/540mb Active color display, CD rom drive, 1.44mb floppy drive	DX4/100,8/840mb Active color display, CD rom drive, 1.44mb floppy drive
$ 5244	$ 5699

THINKPAD 701C

DX4/75,8/540mb disk, active color , pcmcia external floppy , built in sound, full size expandable keyboard, mouse

$ 4399

POWER PC THINKPAD

Model 820 & 850

100MHz RISC PROCESSORS 64-bit bus, 16/32mb ram, camer snap in, windows NT or AIX ready

CALL FOR
SERVER 500
SERVER 320
PS/2 MODELS
PC 300 & 700
THINKPADS
ADAPTERS
SOFTWARE

POWER PC DESKTOP

100MHz /120MHZ/ 133MHZ RISC

PROCESSORS 64-bit bus, 16/32mb ram, windows NT or AIX ready Call for Price

NOVELL

3.12/4.1	5 USERS.....499	stock
3.12/4.1	10 USERS.....1075	stock
3.12/4.1	25 USERS.....1565	stock
3.12/4.1	50 USERS.....1980	ALL
3.12/4.1	100 USERS...2580	IN
3.12/4.1	250 USER5...4560	RED BOX

TOSHIBA

T1960CS	DX2/50	200/340MB	stock
T1960CT	DX2/50	200/340MB	stock
T2400CS/CT	DX2/50	200/320MB.	stock
T2110cs	DX4/75	350MB	stock
T4850CT	75MHZ	8/510MB	stock
T4900CT	75MHZ	8/810MB	stock
T2100	DX2/50	4/260MB	stock
T2105 CS/CT	DX2/50	320MM.	stock
T2150CD	DX4/75	8/540MB	stock
T2110CS	DX4/75	4/340MB	stock
T2130CS/CT	DX4/75	8/520MB	stock
T4000CDT	P/75	8/810MB	stock
T4000CS	P/75	8/810MB	stock

CALL FOR TOSHIBA B-STOCK

BRAND NAME
LOW PRICES LEADER SINCE 1983
We export with international warranty

HEWLETT PACKARD

Printers

D.JET 320...290
HP 4+.....1349
HP 4M+.....1835
D.JET 660C.450
D.JET 540...219
HP4SIMX...4140
HP 4SI.....2789
HP4V.....1835
HP 1200C....939
Sscan 3C....880
HP 4L.....489
HP 5P.....935

HP Vectra

VL3 Pentium
P/75 8/840MB..1850
P/90 8/840MB. 2250
P/100 8/840MB..2399
P/120 16/1GB...3150

Vectra Xu

Pentium 90
16mb, 1GB fast scsi, 4mb Matrox Video card
$:3699

HP PENTIUM SERVERS

NETSERVER LC
NETSERVER LF
NETSERVER LH
NETSERVER LM

HP Omnibook 4000CT

Dx4/100, 8/810mb, active $3399
with 810mb $ CALL for OMNIBOOK 5000 Pentium

Microsoft Solution Provider Windows 95

System setup / installation / upgrade, call us

AST notebook Special

Ascential 900n, Pentium 75 MHz, 8MB ram, Active color with 1.2GB hard Disk $ 5099

Authorized Service Center for IBM, COMPAQ, TOSHIBA, HP
All parts in stock

Notebook Accessories MEMORY

4MB.....199
8MB.....399
16MB.....deal

HARD DRIVES

2.5" 250MB.....199
2.5" 340MB.....299
2.5" 540MB.....345
2.5" 640MB.....599

PCMCIA MODEM

ZOOM 14.4.....159
N/MEDIA 14.4...129
M/HERTZ 14.4..175
M/HERTZ 28.8..299

Desktop Accessories MEMORY

4MB.....150
8MB.....279
16MB.....deal

HARD DISK

420MB.....159
540MB.....169
850MB.....219
1GB.....299
2GB SCSI...899

MODEM

14.4 69
28.8.....145

CPU INTEL

P/75.....DEAL
P/90.....329
P/100.....410
P/120.....650
P/133.....CALL

MOTHER BOARDS

DX2/66.....99
INTEL ZEPA
TRITON.....285

FLOPPY

1.44MB.....31
1.2MB.....41

IDE I/O

VLB.....25
ISA 16 bit.....20

MULTIMEDIA

CD ROM KITS
Discovery 4X KIT....325
HITACHI 4X KIT.....285
VALUE 4X KIT.....269

CD ROM DRIVES

TOSHIBA 4X IDE.....189
TEAC 4X IDE.....189
TOSHIBA 4X SCSI...299
NEC 6X SCSI.....459
PLEXTOR 6X SCSI..call
PLEXTOR 4X SCSI..call

COMPUTER CASE

MID TOWER.....65
MINI TOWER.....59
FULL TOWER.....89
CALL FOR VIDEO CARDS

COMPAQ

Contura 4/33C.....4/170MB.....$969
Contura 410CX.....340MB.....$2265

New Models

Contura 420C...8/430MB..$2385
Contura 420CX..8/430Mb.$2950
Dx4/75, 8mb ram, 10.4" display
Contura 430C...8/730MB..$2770
Contura 430CX..8/730MB.$3379
Dx4/100, 8mb ram, 10.4" display

LTE ELITE MODELS*

LTE Elite 4/40CX 340MB.$2899
LTE Elite 4/75CXL810MB.$4399
*FREE
LTE docking station Value @ $700.00

PROLINEA PENTIUM

P/75 8/720MB...$2599
P/90 16/720MB.$2899
P/10016/720MB.$3150
P/120 16/1GB.....$deal

DESKPRO XL PENTIUM

P/75 16/1GB.. $3485
P/90 16/1GB...$3550
P/100 16/1GB..$3699
P/120 16/1GB..$deal

COMPAQ SERVERS

PROSIGNIA 300 Pentium
PROSIGNIA 500 Pentium
PROLINAT 1000 Pentium
PROLIANT 1500 Pentium
PROLIANT 4000 Pentium
PROLIANT 4500 Pentium
CALL

PRINTER SPECIAL

OKIDATA OL400E.....399
OKIDATA OL410E.....525
EPSON ACTION 1100.....389
OKIDATA ML 590.....425
OKIDATA ML 591.....563
We carry full product range from above manufactures. call for

Optical CD Drives

Recordable CD
Pinnacle RCD 1000.1699
Recordable Drive+scsi card+software
Sony sypressa 920.1599
Recordable drive

Rewritable CD
Sony 1.3GB optical drive.2299
Fujitsu 230MB optical .....deal
We also carry IBM, HP, PANASONIC ,call for price

Computerlane Inc.

Corporate Accounts Volume Discounts Welcome

Outside California: 1-800- 526- 3482
Inside California: 818-884-8644 • Fax: 818-884-8253
7500 Topanga Cyn Blvd, Canoga Park, Ca 91303
Hours: Monday - Friday: 9 - 6

Compaq Is A Registered Trademark Of Compaq. IBM Is A Registered Trademark Of International Business Machines.
All Quoted Prices Reflect A 5% Cash Discount. Visa, MasterCard , Wire Transfer Also Accepted.
Prices Subject To Change Without Notice.

Serving you since 1979

JDR Microdevices®

1850 SOUTH 10TH STREET, SAN JOSE CA 95112-4108

MEMBER DIRECT MARKETING ASSOCIATION

Special Prices for Byte Buyers! Good Through 11/30/95

To receive these special prices, you must mention key code #1070

Upgrades to Run Windows '95 Efficiently

4X IDE CD-ROM Drive

This affordable CD-ROM drive transfers data four times faster than standard single-speed drives!

- 5-1/4" internal drive is MPC, Multisession Photo CD, High Sierra and ISO 9660 compatible

$149.95 BYTE Special!

CDROMI-4 ..... $149.95
CDROMI-2 Double speed drive $99.95

Microsoft's Windows 95

Unlock the potential of your computer with Microsoft's Windows 95 operating system!

- 32-bit preemptive multitasking capability allows multiple programs to work simultaneously
- Improves print and storage performance

WIN95-U	Upgrade, 3-1/2" disks	$89.95
CD-WIN95-U	Upgrade, CD	$89.95
WIN95	Standard, 3-1/2" disks	$189.95
CD-WIN95	Standard, CD	$189.95

2 Floppy Drives in 1 Slot!

By combining two drives into one slot, even systems with limited drive slots have room to add a CD-ROM or tape drive to their standard system case!

- Supports 1.2MB/360kB 5-1/4" and 1.44MB/720kB 3-1/2" diskettes
- Independent jumper selectable drive addresses

$79.95 BYTE Special!

FDD-COMBO $79.95

JDR Multimedia Upgrade Kits

These bundles combine a CD-ROM drive, a SoundBlaster compatible sound card, stereo speakers and a CD.

- 16-bit PC compatible ISA card with CD-ROM interface
- 300kB/sec dual or 600kB/sec quad speed CD-ROM drive uses IDE interface

$159.95 BYTE Special!

JDR-BMMK-2 With 300kB/sec drive $159.95
JDR-BMMK-4 With 600kB/sec drive $249.95

PCI VGA Accelerator

This PCI card features the fast but affordable Trident 9440 chip set.

- 32-bit PC compatible PCI card
- Resolution up to 1600 x 1200 in 16* colors, 1280 x 1024 in 256* colors, 1024 x 768 in 16/256 colors

$99.95 BYTE Special!

MCT-PVGA-1 ..... $99.95

**Note: This mode requires 2MB of RAM*

MCT Network Cards Cost Less!

These cards feature a jumperless design so that software can automatically configure the card for you! A 16kB RAM buffer is included for faster network transmission and reception.

- NE-2000 compatible
- 8/16-bit PC compatible ISA cards

$29.95 BYTE Special!

MCT-10B2	Thin Net BNC connector only	$29.95
MCT-10BC	With RJ45 & BNC connectors	$39.95

Examine Hardware During Boot-Up!

In addition to monitoring Power On Self Test (POST) codes, this card also displays DMA and IRQ activity.

- 16-bit PC compatible ISA card
- Supports BIOS's that generate POST codes,
- Includes AMI diagnostic software

$149.95 BYTE Special!

JDR-PDI+ $149.95

30-Pin SIMMs

PART #	ORG	SIZE	SPEED	PRICE
1MX9-70X9	1M x 9	1MB	70ns	$46.95
4MX9-70X9	4M x 9	4MB	70ns	$175.95
4MX9-60X9	4M x 9	4MB	60ns	$179.95
16MX9-60X9	16M x 9	16MB	60ns	$725.00

72-Pin SIMMs

1MX36-70	1M x 36	4MB	70ns	$184.95
2MX36-70	2M x 36	8MB	70ns	$379.95
4MX36-70	4M x 36	16MB	70ns	$619.00
8MX36-70	8M x 36	32MB	70ns	$1199.00

Keep Your CPU Cool!

Make your processor run cooler with these specially designed fans. They feature easy snap-in installation so you don't have to remove your CPU. The in-line adaptor draws power from your floppy drive.

P54C-FAN	For Pentium processors	$29.95
P54C-FAN-R	Above with refrigeration device	$79.95
486-FAN	For 486 processors	$19.95
486-FAN-R	Above with refrigeration device	$49.95

FREE JDR CATALOGS!

PC PRODUCTS AND ELECTRONIC COMPONENTS

CALL US TOLL-FREE!

1-800-538-5000

High-Performance Motherboards with Triton Chip Set

Using the Intel Triton chip set, these motherboards are prepared to deliver performance into the future!

- 75MHz, 90MHz, 120MHz or 133MHz Intel Pentium Processor with 16kB internal cache memory and Triton chip set
- RAM expandable on board to 128MB, with 4 SIMM sockets, using standard or EDO 1M x 32, 2M x 32, 4M x 32 or 8M x 32 70ns 72-pin SIMMs in multiples of 2 (0kB installed)

75MHz $549 BYTE Special!

MCT-T586-75	75MHz version	$549.00
MCT-T586-90	90MHz version	$649.00
MCT-T586-120	120MHz version	$999.00
MCT-T586-133	133MHz version	$1299.00

SPECIALS FOR BYTE CUSTOMERS ONLY

Leap to 486DX4 Performance!

For increased 486 performance from your 486SX or DX motherboard, simply plug in Intel's DX4 or DX2 OverDrive Processor!

BOXDX4ODP100	Plugs into 33MHz socket	$199.95
BOXDX4ODPR100	Replaces 33MHz CPU	$199.95
BOXDX4ODP75	Plugs into 25MHz socket	$149.95
BOXDX4ODPR75	Replaces 25MHz CPU	$149.95
BOXPODP5V63	Pentium OverDrive replaces 25MHz and 50MHz 486 CPU's	$289.95
BOXPODP5V63	Pentium OverDrive replaces 33MHz and 66MHz 486 CPU's	CALL

Static RAM Cache Upgrades

PART #	ORG	SPEED	# PINS	PRICE
4KX4-15DIP	4k x 4	15ns	22/.3"	$4.95
7C185-15	8k x 8	15ns	28/.3"	$4.95
6288-20	16k x 4	20ns	22	$3.95
HM62832-20	32k x 8	20ns	28/.3"	$6.29
4C187-15	64k x 1	15ns	22	$6.99
6208-25	64k x 4	25ns	24/.3"	$8.49
7C1024-20	128k x 8	20ns	32/.4"	CALL

Seagate Hard Drives

Upgrade to a new, high-quality, high-capacity Seagate hard drive! Our prices have never been lower.

- As low as 27¢ a meg!
- Fast ATA and Fast SCSI-2 drives accelerate performance

ST-3660A	545MB, 14ms, Fast ATA,31¢/MB	$169.95
ST-5850A	854MB, 11ms, Fast ATA-2, 27¢/MB	$229.95
ST-31220A	1.08GB, 12ms,Fast ATA-2, 30¢/MB	$319.95
ST-32430N	2.1GB, 11ms, Fast SCSI-2, 43¢/MB	$899.00

SPECIALS FOR BYTE CUSTOMERS ONLY

Sales 1-800-538-5000 Toll-Free Fax Ordering 1-800-538-5005 Local/International 1-408-494-1400 Order 24-Hours-A-Day By Phone or Fax

KEY CODE 1070

TERMS: For shipping & handling include $4.29 for ground & $6.99 for 2nd day air. Orders over 1 lb. and foreign orders may require additional shipping charges—contact our Sales Dept. for the amount. CA residents must include applicable sales tax. Prices subject to change without notice. We are not responsible for typographical errors. We reserve the right to limit quantities and to substitute manufacturer. All merchandise subject to prior sales. A full copy of our terms is available upon request. Items pictured may only be representative. JDR, the JDR logo, JDR Microdevices, and the MCT logo are registered trademarks of JDR Microdevices. Modular Circuit Technology is a trademark of JDR Microdevices. Copyright 1995 JDR MICRODEVICES. Other trademarks are the property of their respective owners.

Computer Gate is your international supersource for PC accessories, multimedia and network products.

$2.95 Power Strip

Computer Gate International

For a FREE Catalog call 408 730-0673

Circle 236 on Inquiry Card (RESELLERS: 237).

IERC HEAT DISSIPATORS AND CLIPS KEEP P6s™ COOL!

IERC is now offering a new line of heat dissipators and clips* designed to cool off P6 microprocessors. The clips attach directly to the microprocessor LIF or ZIF socket. The installation and removal is easy and no tools are needed for the ZIF sockets. Microprocessors with or without heat spreaders can be accommodated.

IERC is also offering a high reliability fan/heat dissipator assembly for P6 microprocessors. Custom microprocessor heat dissipators with various clip configurations are also available. Call IERC today.

™P6 is a registered trademark of Intel Corp. *Patent pending.

IERC International Electronic Research Corp.
135 W. Magnolia Blvd. • Burbank, CA 91502
TEL: (818) 842-7277 • FAX: (818) 848-8872

Circle 210 on Inquiry Card.

Need More PCI Slots?

Add 7 more PCI slots, by using a Bit 3 PCI Expansion Unit!

Phone: 612/881-6955 Fax: 612/881-9674
For UK: 0800/966-819 Internet: info@bit3.com

BIT 3 COMPUTER CORPORATION
8120 Penn Avenue South
Minneapolis, MN 55431-1393

Circle 245 on Inquiry Card.

SERIAL/PARALLEL I/O ADAPTERS

RS-232/422/485 • Dual Serial
Quad Serial • Serial/Parallel

16550/16650 Buffered UARTs
Flexible Address and Interrupt Capability

Ask about our new PCI I/O Products!

Globetek • Made in USA • Lifetime Warranty • Unlimited Technical Support

Globetek, Inc.
3505 E. Royalton Rd. Ste. 160 • Broadview Hts., OH 44147
800-229-4640 • 216-526-8550 • Fax: 216-526-8817

Circle 238 on Inquiry Card (RESELLERS: 239).

Bar Code Solutions

Videx data collection equipment is designed for work on the go. Cast-metal cases protect the products and allow them to work reliably in harsh environments.

Videx Products...Built Tough...Built to Last!

Videx 1105 N.E. Circle Blvd., Corvallis, OR 97330
503-758-0521 • Fax 503-752-5285

Circle 197 on Inquiry Card.

Circle 206 on Inquiry Card (RESELLERS: 207).

Rhetorex
Voice Processing boards make CTI a reality.

If you're asking "what's CTI," you're missing one of the hottest new technologies going.

Computer Telephony Integration links PC-based computer applications to the telephone network, providing voice/fax mail, interactive voice response, voice/fax servers and more.

Interested? Maybe you're already developing a CTI application. Then it's time to discover Rhetorex.™

For the best value in CTI technology–from our 2 and 4 port DSP-based voice and fax processing boards, to our 24-port platform–give Rhetorex a call. And start making CTI a reality today.

RHETOREX

Rhetorex, Inc., 200 E. Hacienda Ave., Campbell, CA 95008-6617
Tel. (408) 370-0881; Fax (408) 370-1171

All trademarks identified by the ™ symbol are trademarks of Rhetorex, Inc.
All other trademarks belong to their respective owners. © 1993 Rhetorex, Inc.

Circle 194 on Inquiry Card.

LET YOUR COMPUTER DO THE TALKING!

Integrated Voice/Fax Mail

integrates major voice/fax applications plus program control into one full-featured high performance software. PC-AT/386/486 based. Menu driven. Easy to use. Full support for Rhetorex, New Voice, Dialogic, Bicom, Pika, TTI and Intel voice and fax hardware. Supports up to 32 voice lines and up to 8 fax lines.

Hardware + Software Kits
2 voice lines kit starts at **$595**

Fax-on-Demand lines: 818-368-4566 or 818-368-8848

- Automated Attendant
- Unlimited Audiotex
- Voice Mail
- Talking Yellow pages
- Telemarketing
- Fax Mail
- Fax-on-Demand
- Fax Broadcasting
- Date/Party lines
- Int'l Call Back

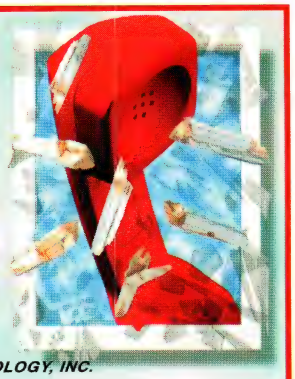
SigmaTech Software
Tel: (818) 368-6132 Fax: (818) 368-7859
10801 Bismarck Ave., Northridge, CA 91326 USA
(Resellers/Dealers/OEMs/Private labels are welcome)

Circle 202 on Inquiry Card (RESELLERS: 203).

BREAK INTO WINDOWS!

- Voice Mail
- Auto - Attendant
- Fax - On - Demand
- Programmers' Tool Kits

For Sales & Information CALL:
800.685.4884
WE SELL WEB SPACE. ASK US!
(Developer/OEM packages available) VISA–MC–AMEX–COD



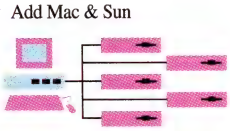
TALKING TECHNOLOGY, INC.
1125 Atlantic Avenue, Alameda, California, 94501
Voice: 510.522.3800 Fax: 510.522.5556

Circle 196 on Inquiry Card.

CONTROL ALL YOUR SERVERS
FROM ONE KEYBOARD, MONITOR AND MOUSE

MasterConsole®
Save space, time and money

- 2 - 64 Computers
- Any mix of PCs; PS/2 & Serial Mouse
- Add Mac & Sun
- Keyboard/Mouse Emulation
- AUTOSCAN™
- Front Panel & Keyboard Selection
- Remote Access to 150'
- Desktop or Rack Mount



CALL TODAY! 800-RCI-8090 x 71
RARITAN COMPUTER, INC. (908) 874-4072 Fax (908) 874-5274
10-1 Ilene Court, Belle Mead, NJ 08502 ■ sales@raritan.com ■ http://www.raritan.com

30-DAY MONEY BACK GUARANTEE FULL 1-YEAR WARRANTY

Networld+Interop, Atlanta, Booth #4646, Sept. 27–29 ■ COMDEX/Fall, Las Vegas, Booth #LC 5000, Nov 13–17
INTERNATIONAL France: (33) 1-64 67 64 67 Germany: (49) 180-522-8222 Ireland: (353) 1-454-0589
Italy: (39) 2-66800548 Japan: (81) 3-3255-1517 Korea: (82) 2-412-5775
Netherlands: (31) 10-4423313 Sweden: (46) 020-788850 Switzerland: (41) 22-7532200
UK: (44) 244-520222 or (44) 344-424-333 RCI Taiwan: (886) 2-218-1117 RCI Europe (31)-10-4586-673
INTERNATIONAL RESELLERS INQUIRIES WELCOME — CONTACT RCI (908) 874-4072

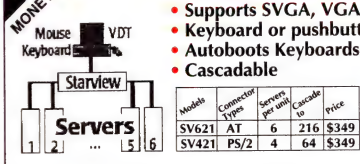
Circle 211 on Inquiry Card (RESELLERS: 212).

$349.00 MONEY BACK GUARANTEE

STARVIEW
PS/2 Model SV421

Control up to 216 Servers
with just 1 Monitor, Keyboard, and Mouse

- Supports SVGA, VGA, and Multisync Monitors
- Keyboard or pushbutton CPU selection
- Autoboots Keyboards and mice (SV421)
- Cascadable



Models	Connector Types	Servers per unit	Cascade to	Price
SV621	AT	6	216	$349
SV421	PS/2	4	64	$349

Rack Mount Available

110 VOLT CSA/UL

USA/Canada: 800-265-1844 (ext. 231)
Fax: (519) 438-6555 / Internet E-Mail: *startech.computer@onlinesys.com*

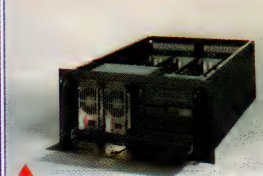
StarTech COMPUTER PRODUCTS
USA • Canada • UK • Germany • Hong Kong

European/International Distribution use Fax or Internet or Call:(519) 438-8529 (ext.231)

Visa/Mastercard/American Express

Circle 231 on Inquiry Card (RESELLERS: 232).

Industrial Strength PC Solutions - Made in USA



20 Slot Hot Swap Redundant PS

800-927-5464
408-452-9200 • 408-452-9210 FAX

Rack Mount Products - Designed, Built in USA
- Rack mount Systems - 386 to Dual Pentiums
- Rack mount Chassis - Up to 20 Slots Custom Design & Modifications available
- Rack mount Monitor - Up to 20"
- Rack mount Cherry 101 Keyboard
- HDD / CD-ROM Enclosure - Hot Swappable
- NEMA 4/12 Workstation

Single Board Computers
- 386/486/Pentium - ISA / EIAS / VESA / PCI
- Passive Backplanes - from 3 slots to 20 slots Segmented Backplane Available

CALL or FAX for Full Catalog
2032 Bering Drive • San Jose, CA 95131
In-House Design • In-House Manufacturing • Custom Configurations

Circle 200 on Inquiry Card (RESELLERS: 201).

Computer Systems

Rackmount

- ENCLOSURES for 386, 486 & Pentium
- KEYBOARDS
- MONITORS
- DRIVE ENCLOSURES

PC Enclosures *from $300*

Monitor: *10" Super VGA Color from $650*

Keyboards: *Drawer, Shelf & Panel from $85*

- *Excellent Air Flow & Cooling*
- *Accepts Most Motherboards and Passive Backplanes*
- *Rack & Desk Models • Up to 20 Slots • Rugged, Modular Construction*
- *200, 300 & 400 Watt Supplies, UL, CSA, TUV • Made in U.S.A.*

Call or write for descriptive brochures, prices or applications assistance:

INTEGRAND RESEARCH CORP

8620 Roosevelt Ave. • Visalia, CA 93291

209/651-1203 FAX 209/651-1353

PC™ IBM • 386/486 Pentium™ Intel • Drives and computer boards not included.

Circle 187 on Inquiry Card.

PC SYSTEMS IN ROM

See us at Comdex/Fall '95 Sands booth #S3692

KS-1 XT CPU card. NEC V40, 1 MB Dram, Sram, Flash, Pcmcia, 3 srl, 2 par, modem, A/D. **$129 up**

KS-9 AT (F8680) battery operated CPU with 2M Flash, Sram, CGA contr., Pcmcia, 3 srl, 2 par. **$249 up**

PC-in a-Box Complete system with KS-9 CPU, 256K Psram, 192x128 LCD, 53 kypd, 1 srl, pwr sup, box. **$399**

KILA Sales: **1-800-505-6749**
303-444-7737 • Fax 303-786-9983

Circle 189 on Inquiry Card.

INDUSTRIAL COMPUTER SYSTEMS

N E W Pentium CPU Card !!

Full Line of Rackmount Products

Rackmount Systems: 286 to dual pentium
Rackmount Chassis: Over 20 different models
Rackmount Monitors: 9" to 20" (dual monitors avail.)
Rackmount Keyboards: Multilevel, membrane
Drive Enclosures: Disk/CD array enclosures
Redundant P/S: Hot Swap up to 3 P/S

Intel Pentium P54C/P55C/P55T up to 150 MHz CPU
Four 72 pin SIMM Sockets, DRAM size up to 512 MB
Standard 256KB external cache (up to 1MB)
Burst SRAM socket supported (512KB/1MB)
SRPC-21[illegible] Award licensed BIOS stored in Intel Flash ROM

19" Rackmount Chassis

- Locking front panel access
- AT M/B or 14 slot passive B/P
- Filtered positive air pressurization
- Shock-mounted drive bay
- Desk top version available
- 250W P/S (UL, CSA & TUV) - optional

PCI SCSI-II Interface: Compatible with Adaptec 2940 SCSI bus master

PCI/IDE HD interface: Supports up to Four enhanced IDE Hard Disk

Siliconrax
1050 E. Duane Ave. Bldg. I, Sunnyvale, Calif. 94086

1-800-700-8560

Dealers & Distributors Welcome! Ask for Quantity Discounts!

Circle 220 on Inquiry Card.

Computer Systems • Data Acquisition

Rackmount Solutions

RACKMOUNT COMPONENTS – QTY 25 PRICING

Rackmount Chassis 19"x7"x17"	$131
Rackmount VGA Monitor	$531
Rackmount Monitor Shelf	$113
Rackmount Cherry Keyboard Drawer	$200

RACKMOUNT PLATFORMS – Qty 1 Pricing

RMS486DX2-66 EISA	$1593	RMS486SX-33	$915
RMS486DX-33	$1136	RMS386SX-33	$665

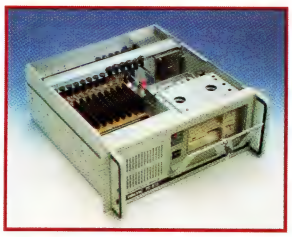
RACKMOUNT CHASSIS – 15 Models up to 20 Board Slots
SLOT CPU BOARDS – EISA/ISA 486, 486SX, 386, 386SX
RACKMOUNT MONITORS – Super VGA & Monochrome
RACKMOUNT KEYBOARDS – High Quality Cherry KB
RACKMOUNT SWITCH – Video/KB up to 12 CPUs
RACKMOUNT CABINET – Modular from 21" to 96" high

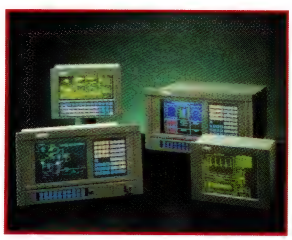
Exclusive International Distributor Program now Available

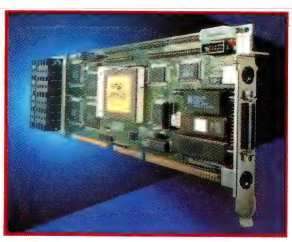
VALLEY TECHNOLOGY INC.
2468 Armstrong Street, Livermore CA 94550
(510) 447-2030 FAX: (510) 447-4559

Circle 199 on Inquiry Card.

Industrial PC Solutions







- Rackmount PCs
- Industrial PC Chassis
- Industrial Workstations
- Panel Display PCs
- Pentium/486/386 CPU Cards
- RS-232/422/485 Interface
- Analog and digital I/Os
- Data Acquisition

*Call **800-800-6889** to receive a **FREE** 100-page Solution Guide for your OEM or system integration needs.*

ADVANTECH
750 E. Arques Ave.
Sunnyvale, CA 94086
408-245-6678, Fax 408-245-8268

Circle 183 on Inquiry Card.

8 BIT, 250 MSPS A/D Card

- √ 12 bit, 60 MSPS A/D
- √ Software Drivers
- √ Up to 16 Meg Memory

PCI BUS Available!!

CSLITE	8 bit, 40 MSPS	$595
CS250	8 bit, 100 MSPS	$3500
CS2125	8 bit, 250 MSPS	$4995
CS1012	12 bit, 20 MSPS	$4995
CS6012	12 bit, 60 MSPS	$6995

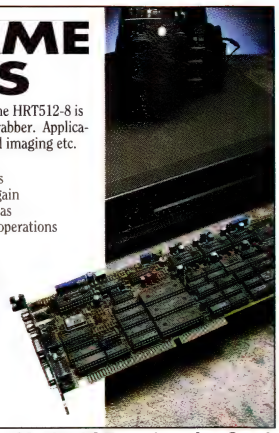
U.S Prices listed. International prices may vary

GaGe 1-800-567-GAGE

Gage Applied Sciences Inc.
5610 Bois Franc, Montreal, QC, Canada H4S 1A9
From outside North America, call +1-514-337-6893
Fax: (514) 337-8411, BBS: (514) 337-4317

Circle 184 on Inquiry Card.

VIDEO FRAME GRABBERS



Turn your PC into a powerful Imaging Workstation. The HRT512-8 is a multifeatured high performance industrial frame grabber. Applications include machine vision, robotics, microscopy, medical imaging etc.

- 512 X 512 resolution, 256 grey scale levels, LUT, overlay
- External trigger, EX/IN pixel clock, optional square pixels
- NTSC & PAL video input/output, genlockable, high S/N gain
- Free library of over 100 image processing routines, such as histograms, convolutions, edge detections, point & area operations arithmetic & logical operations between frames

HRT512-8 ..... $995
HRT-2BUF (optional second image buffer) $199
HRT-LIB (Free with purchase of HRT512-8) $399

HRT

HIGH RES TECHNOLOGIES INC.
P.O. Box 76, Lewiston, NY 14092 USA
Phone 416-497-6493 ext 106 Fax 416-497-1636

Circle 185 on Inquiry Card.

Portable Data Acquisition

for Notebook PCs

Measure volts, thermocouples, RTDs, strain gages, isolated high voltage, and more—up to 256 channels at 10 µsec/channel. DOS, Windows, and icon-based software support included.

From $695

12- or 16-bit 100 kHz DaqBooks™

High-speed PCMCIA or parallel port connection

IOtech

the smart approach to instrumentation™

(216) 439-4091
Fax (216) 439-4093

IOtech, Inc. • 25971 Cannon Rd. • Cleveland, OH 44146

Circle 188 on Inquiry Card.

DAQValue™

Portable Data Acquisition

Performance and Portability – We Give You Both.

DAQCard™ Series
- Six Type II PCMCIA cards
- Up to 100 ksamples/s
- 12-bit resolution
- Analog input and output
- Digital I/O and timing I/O

SCXI Signal Conditioning
- Parallel port or PCMCIA interface
- Expandable to 384 channels
- DC power, optional battery pack

DAQPad™ Series
- Parallel port interface
- 100 ksamples/s
- 12 or 16-bit resolution
- Analog, digital, and timing I/O
- DC power, optional battery pack

Software
- NI-DAQ® driver software for:
  - LabVIEW®
  - LabWindows®/CVI
  - Basic, C/C++, Visual Basic, Pascal, and many more

Call for FREE DAQ Designer™ Software
(800) 433-3488 (U.S. and Canada)

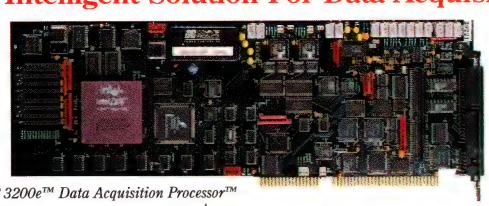
NATIONAL INSTRUMENTS™
The Software is the Instrument®

U.S. Corporate Headquarters • Tel: (512) 794-0100 • Fax: (512) 794-8411
E-mail: info@natinst.com • WWW: http://www.natinst.com

© Copyright 1995 National Instruments Corporation. All rights reserved.
Product and company names listed are trademarks or trade names of their respective companies.

Circle 191 on Inquiry Card.

The Intelligent Solution For Data Acquisition



DAP 3200e™ Data Acquisition Processor™

Analog I/O to 769K samples per second
Digital I/O to 1.6M samples per second
Up to 512 analog inputs on one DAP™
Up to 128 digital inputs on one DAP
Up to 66 analog outputs on one DAP
Up to 1024 digital outputs on one DAP

On-board 486: SX, SX2, DX2, or DX4
Real-Time Data Acquisition–Windows or OS/2
Real-Time Process Control–Windows or OS/2
On-board FFT, FIR, PID, and more
VBX Custom Control

MICROSTAR LABORATORIES™

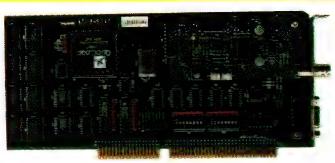
206-453-2345 / fax 206-453-3199
info@mstarlabs.com
http://www.mstarlabs.com/mstarlabs/

2265 116th Avenue NE
Bellevue, WA 98004

LOW COST/FAST A/D BOARD

Model AD-8H50AT for PC/AT ISA Bus

- 50 MSPS, 8 bit **$3,595 with 1 MB**
- Up to 4 MB Memory
- Versatile Function
- Easy Programming
- Free Demo Program



THAMWAY

Worldwide agent - Sci Tran Products
1734 Emery Drive, Allison Park, PA 15101 U.S.A.
Tel: (412) 367-7063 Fax: (412) 367-7063
Headquarters - Thamway Co., Ltd.
3-9-2 Imaizumi, Fujishi, Shizuoka 417 JAPAN
Tel: (0545) 53-8965 Fax: (0545) 53-8978

Circle 242 on Inquiry Card.

Terminate SCSI Problems

SCSI*Vue*™ *Active Terminator*

From: $59

Benefits:
- Improves SCSI Bus Performance
- Less Errors; More Reliable Data Transfer
- Diagnoses Problems • Analyzes Signal Quality

Features:
- Active Regulation
- Status Indicators • Gold Contacts

Optional Remote Display

From: $39

SCSI*Vue*™ *Gold Diagnostic Cables*

Benefits:
- No Loss Of Important Data
- Faster Performance • Test Cable Integrity

Features:
- Diagnostic Indicators • Large Ferrite Filters
- Triple Shielding (Unique Cable Design)
- Double Gold 20u" Plated Connectors
- Extra Heavy 26 Gauge Wire

SCSI*Vue*™ *Teflon Internal Cables*

From: $39

Benefits:
- Less Errors, Ultimate Performance
- Silver Wire Improves Signal Quality

Features:
- Perfect 90 Ohm Impedance Match
- Triple Pronged Connector With Gold contacts

The SCSI Solution Company

Granite Digital

3101 Whipple Rd., Union City, CA. 94587
Ph: 510-471-6442 Fax 510-471-6267

Circle 204 on Inquiry Card (RESELLERS: 205).

Keyboards • Laptops & Notebooks

CUSTOMIZE YOUR KEYBOARD

- Custom Key Imprinting - all brands!
- Custom Colored keys for IBM®, DEC®, Wyse®, Key Tronic®, Cherry®, and more!
- Custom and stock keytop label kits for software support & languages.
- Full color keyboard templates made to your exact specifications.
- Word Perfect Keyboards.
- Cyrillic, Arabic, Hebrew, etc. Keyboards

CUSTOM HOTLINE 800 937-1337

from the leader in Keytop Innovations™

Hooleon CORPORATION

Dept. BYTE, 260 Justin Dr.
Cottonwood, AZ 86326
520 634-7515
FAX 520 634-4620

Circle 186 on Inquiry Card.

Laptop/Notebook UPGRADES

CPU and Hard-drive Upgrades for all major brands.

- 486SLC2 clock-doubled CPU upgrades for 286/386SX's
  - IBM 486SLC2 (with 16KB cache) for true 486 performance.
- 386DX to IBM 486BL3 clock-tripled CPU upgrades.
- i486SX/DX to i486DX4 clock-tripled CPU upgrades.
- Upgrade-packages (CPU & hard-drive) from $495.00
  -- Packages include installation, file transfer & return shipping.

Request our new Upgrade Guide
Now available! 486 upgrades for most IBM PS/2 models.

CORPORATE Upgrades, Inc.

(800) 240-6190

US/Canada: Tel: (916)536-3710 Fax: (916)536-3719 PO Box 289, Fair Oaks, CA 95628
Europe: Tel: (+46) 8-751-7668 Fax: (+46) 8-751-4601 Box 1189, Kista, Sweden
All trademarks are the property of their respective owners.

Circle 233 on Inquiry Card (RESELLERS: 234).

Let your *"TRUE COLORS SHINE THROUGH"* when you advertise your computer products in the

BYTE

HARDWARE/SOFTWARE SHOWCASE

Call for more details:
(603) 924-2618

Mail Order • Memory/Chips/Upgrades • Programmable H/W

if you were thinking of expanding your storage or adding a CD-ROM, you might want to give us a call.

We specialize in expansion housing, from one 3-1/2" portable, or one 5-1/4" "Mac" ZFP all the way up to eighteen 5-1/4"HH.

CALL US FOR A PORTFOLIO TO ORDER 800-75-WETEX
OUTSIDE CALIFORNIA 93839

WETEX INTERNATIONAL (USA) CORP.
1122 W. Washington Blvd., Suite D, Montebello, CA 90640
Tel: (213) 728-3119, Fax: (213) 728-3203

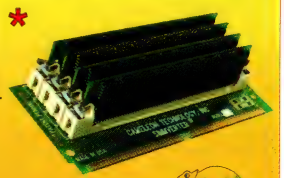
Circle 244 on Inquiry Card.

SIMMVERTER™

Save $100s in memory when upgrading to newer PC Systems!

SimmVerter™ converts your old 30 pin SIMMs to 36 bit, 72 pin connector SIMMs...

...for only $19 *



- ✔ Converts four 1MBx9 SIMMs to one 1MBx36 SIMM (4MB).
- ✔ Converts four 4MBx9 SIMMs to one 4MBx36 SIMM (16MB).
- ✔ Guaranteed to work in any system using 36 bit memory.
- ✔ Works along with other 36 bit and even 32 bit SIMMs.
- ✔ Up to 4 adapters can be installed side by side.
- ✔ 4 models to choose from to fit any system.
- ✔ Patented and designed in the USA.

To Order call 1-800-440-7466

OEM, dealer & distributor inquiries welcome !

* Price per adapter. Add $5 for shipping and handling and sales tax where applicable.

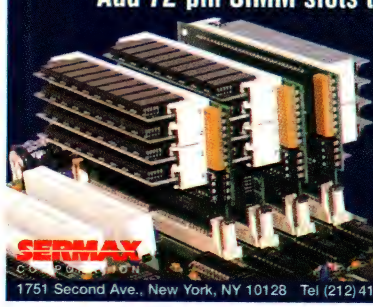
CAMELEON TECHNOLOGY, INC.
1976 Lowney Way
San Jose, CA 95131
Ph. 408-937-0390
Fax. 408-937-0391

Circle 229 on Inquiry Card (RESELLERS: 230).

SIMMSTACK™

Win 95 Ready

Convert 30-pin SIMMs into 72-pin SIMMs. Add 72-pin SIMM slots to your system.



- Plug & Play installation
- 486, Pentium & Mac compatible
- Totally transparent
- Will fit virtually all systems
- On board logic ICs
- Each adapter individually tested
- Lifetime warranty
- Manufactured since 1993

800-209-7126

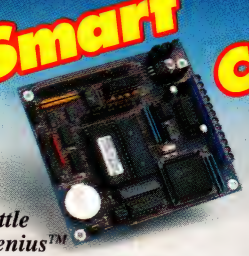
SERMAX CORPORATION

1751 Second Ave., New York, NY 10128 Tel (212) 410-1597 Fax (212) 410-0452

yes It runs with NetWare

Circle 240 on Inquiry Card (RESELLERS: 241).

Smart Controller



Little Genius™ Starting at $119, Qty 1

Z-World's C-programmable controllers are ideal as the brains for control and data acquisition applications. Features include digital I/O to 400 lines, ADCs, DACs, relays, solenoid drivers, RS232/RS485, battery-backed RAM, clock, watchdog, LCDs, keypads, enclosures and more. Use our simple, yet powerful, Dynamic C™ development system ($195 integrated editor, compiler and debugger) for quick project completion!

ZWORLD ENGINEERING

1724 Picasso Avenue
Davis, CA 95616
916.757.3737
916.753.5141 FAX

24-Hour AutoFAX
916.753.0618.
Call from your FAX.
Request catalog #18.

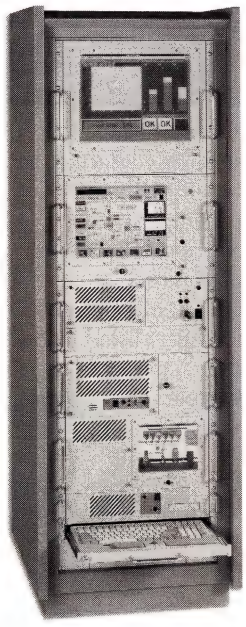
Circle 198 on Inquiry Card.

Pentium™ Industrial

Rugged computers, monitors and keyboards for industry use. Standard or custom designs!

❑ Industrial ❑ Telecommunications ❑ Military

- All-in-one 80486 or Pentium CPUs. Up to 3 per system.
- 3-20 slot ISA/PCI backplanes.
- 230W to 440W power supplies, 115/230 VAC or 24/48 VDC.
- Modular "hot swap" electronics.
- Shock mounted rugged designs with up to 4 fans, 9 drives.
- Low profile 3.5" to 8.75" rack chassis. FCC/NEBS compliant.
- 10", 14" or 17" rack monitor
- Rack keyboard with trackball.
- 12 standard designs to choose. Low cost specials to your need.
- Made in USA. 2 year warranty.



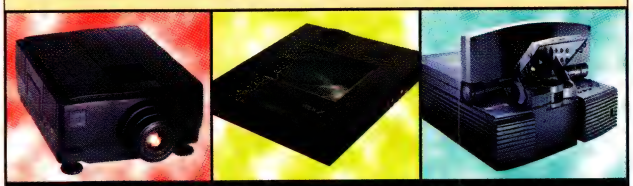
Micro Alliance

Refining PCs for Industry

619-598-1900

Circle 246 on Inquiry Card.

IF WE DON'T SELL IT, IT'S NOT WORTH LOOKING AT.



PANELIGHT IS YOUR ONE STOP SHOP FOR ALL LEADING BRANDS • SALES, RENTALS, & LEASES MONEY-BACK GUARANTEE • OVERNIGHT SHIPPING.

PANELIGHT OFFERS THE BEST IN SELF-CONTAINED LCD PROJECTORS, LCD PROJECTION PANELS, SUPER-BRIGHT OVERHEADS, MULTIMEDIA MONITORS, AND ACCESSORIES FROM THE WORLD'S LEADING MANUFACTURERS; HITACHI, IN FOCUS, PROXIMA, NEC, nVIEW, POLAROID AND OTHERS.

CALL THE EXPERTS AT PANELIGHT DISPLAY SYSTEMS, INC.

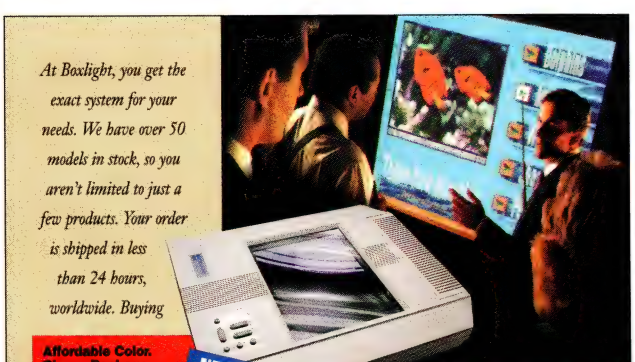
CALL PANELIGHT FOR OUR FREE CATALOG: 1-800-726-3599.

MON.-FRI., 6:30AM-5:30PM P.S.T.
24-HR. FAX: 415-986-3817

PANELIGHT DISPLAY SYSTEMS, INC., P.O. BOX 190940, SAN FRANCISCO, CA 94119. OR CALL 415-772-5800.

Panelight DISPLAY SYSTEMS, INC.

Circle 243 on Inquiry Card.



At Boxlight, you get the exact system for your needs. We have over 50 models in stock, so you aren't limited to just a few products. Your order is shipped in less than 24 hours, worldwide. Buying presentation equipment doesn't get any more convenient. And our 30-day money-back guarantee means there's absolutely no risk. So why wait? Pick up the phone. Call today!

Affordable Color. Classy Package
- Brightest color at any price.
- New faster response time.
- Compact, prtable design.
- Free remote & cables.
- Mac or PC Compatible

NEW LOWER PRICE!

$1999

Boxlight ColorShow™ 1200

WHEN WORDS ARE NOT ENOUGH...

CALL FOR OUR LATEST SPECIALS!

CALL BOXLIGHT!

Wide variety of projectors and panels in stock!

1-800-762-5757

Monday through Friday, 6am–5pm, Pacific Time.

Why buy from Boxlight Direct? ■ Immediate dialog with knowledgeable people the first time you call. ■ Immediate help in finding the most appropriate equipment for your unique situation — from our on-hand inventory of over 50 models. ■ Immediate service of everything we sell by our in-house service group. Industry leading Uptime Assurance Program. ■ Immediate overnight delivery to multiple world-wide locations. ■ Hassle-free 30 day money back guarantee. ■ Rentals. ■ Free lifetime after-the-sale technical support should you have any questions. ■ Call today and ask for a catalog.

BOXLIGHT DIRECT

Circle 218 on Inquiry Card (RESELLERS: 219).

CODEBLUE™ • Win 95 Disaster Recovery

- **Turns a SCSI tape drive into a "LOGICAL" disk.**
- **Works with Windows 95 - Long file names.**
- **Disaster recovery for Windows 95.**
- **TDWIN Graphic User Interface for Windows 95.**
- Backup & Secondary storage.
- Random Access Tape files
- Read/write files directly to tape.
- Fast system crash recovery.
- Crash Guard protects your data

Perfect solution for:
Multimedia • CAD/Engineering
Graphics • Data Acquisition
Document/DATA Archival • Imaging

PCComputing MVP '94 FINALIST

Supports 4MM DAT/DDS-2 8MM, QIC SCSI tape drives

ADPI - **Hewlett-Packard JetStore/SureStore** - Colorado Power-Tape/DAT - **Conner** - Contemporary Cybernetics - **Exabyte** - Legacy - Mountain - PCM - **Sony** - **Tandberg** - Tecmar - **WangDAT** - others.

800-827-3372

Voice:715-235-3388 • 715-235-3818: FAX

HEWLETT PACKARD SureStore Tape Referenced Solution

TAPEDISK®

We make tapes work like disks!

Innovative Dual Storage Technology

Circle 213 on Inquiry Card (RESELLERS: 214).

Security • Tape Drives • UPS

IF YOU THOUGHT A MODEM SECURITY SYSTEM COST TOO MUCH, THINK AGAIN.

Computer Break-In Costs Company Over $ 100,000.

Don't let your modem lines be an open door for crime. Use MODEM LOCK with its powerful hardware DES encryption to protect your business. According to the FBI, computer crime costs business millions of dollars each year. Call our Fax-Back number now to learn more about how MODEM LOCK works with your hardware to lock out intruders.

CALL US!
Tel: 310-379-1189 or
24 Hour Fax-Back Info
310-597-7145

ADVANCED ENGINEERING CONCEPTS, INC.

Circle 221 on Inquiry Card.

Tape Solutions

...The Tape Experts

• 9 TRACK
• 3480 • 3490 • 3490E
• LIBRARIES

Qualstar Corporation
6709 Independence Avenue
Canoga Park, CA 91303

FAX (818) 592-0116 TEL (818) 592-0061
(800) 468-0680

Circle 193 on Inquiry Card.

PC/Mainframe/Mini Information Exchange

Featuring QUICKTAPE™

- Tape Transfer and Format Conversion
- EBCDIC ⟷ ASCII Data Manipulation
- AS/400, TK50, and ¼" QIC Drives
- UNIX Tar and DEC Save Set Options
- Reseller Inquiries Invited

QUICKCOPY™ Tape Duplication

READ/WRITE 9-TRACK
3480 • 8MM • DAT on
YOUR PC NOW!

Call Us ... (317) 842-2077 or
1-800-248-3475

SHAFFSTALL CORPORATION
FAX: (317) 842-8294

Media Conversion Systems Since 1973

Circle 208 on Inquiry Card (RESELLERS: 209).

250W/+24VDC Input
250W/-48VDC Input DC-to-DC Converter

Contact us for +12VDC input model !!

- ACE-925T: -40VDC to -57VDC
- ACE-925C: 18VDC to 30 VDC
- Input protection against wrong polarity
- Operating Temp: 0 C ~ 50 C
- Storage Temp: -40 C ~ +75 C
- Dimensions: 5 7/8 X 5 1/2 X 3 1/2

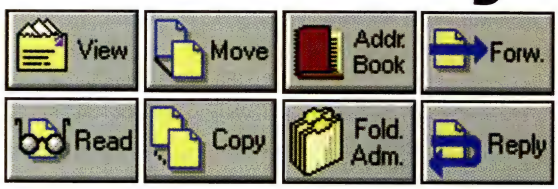
ACI SYSTEMS

Western Region: 1-800-983-1177
Eastern Region: 1-800-886-2243

Circle 227 on Inquiry Card (RESELLERS: 228).

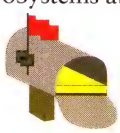
Communications/Networking • Mathematical/Statistical

E-Mail Made E-asy.



Now PC users on a Unix network can have a Windows-style, Windows-fast & easy interface to Internet and Unix email. Just use EMBLA!

- It's Windows "drag & drop" simple
- Remote users — save on your phone bill! Select and download only the mail you need.
- Supports MIME, IMAP & standard Windows socket API. Call one of the resellers listed below to order. For more information, contact ICL ProSystems at: marcomms@pro.icl.se
  http://www.pro.icl.se



EMBLA™

Only $99 Single User License

UniDirect
800-755-8649
sales@unidirect.com

software.net
800-617-SOFT
http://www.software.net

J.P. Brown (In Canada)
416-494-0472
davef%jpbrown@uunet.ca

Circle 222 on Inquiry Card (RESELLERS: 223).

Talkie™

INTEGRATED I.V.R.

- INTERNATIONAL CALL BACK
- LONG DISTANCE RESELLER
- PREDICTIVE DIALERS
- DATE-LINES \ CHAT LINES
- CONFERENCING

BUNDLE 4 PORTS-$715

- VOICE-MAIL
- AUTO-ATTENDANT
- FAX-ON-DEMAND
- AUDIOTEX
- OUTDIALING
- TELEMARKETING
- APP-GEN & MORE

Computer TELEPHONY 1•9•9•4 PRODUCT OF THE YEAR

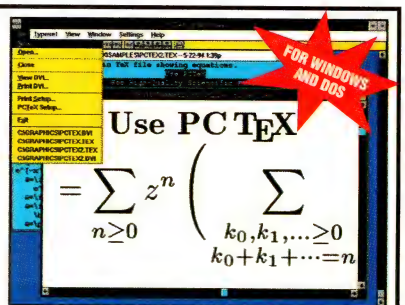
"Very good product for VARs"
Computer Telephony, Mar 94

U.S.:1-800-TALKIE4 Fax:716-855-2244 CAN:416-665-7638

Circle 225 on Inquiry Card (RESELLERS: 226).

PC TEX

For High-Quality Scientific Publishing, use PCTEX Typesetting Software.



Make all your documents and math formulas look their best!

For a free brochure, call 800/808-7906 or 415/388-8853
Fax: 415/388-8865 E-mail: pti@crl.com WWW: http://www.crl.com/~pti/
Personal TEX, Inc. 12 Madrona Street Mill Valley, CA 94941 USA

Circle 192 on Inquiry Card.

FAST TRAK! TRAINING SYSTEM

for Novell's CNE Certification

ONLY $595 plus $20 shipping & handling

Test Master ASSESSMENT SOFTWARE INCLUDED

Featuring the best-selling
Novell's CNE Study Guide

plus the complete
So You Wanna Be a CNE?!
video series

Conforms to Novell's NEW CNE PROGRAM announced April 11, 1995

- Train all your LAN managers for one low price.
- Study in the convenience of your home or office.
- Learn at your own pace.
- Save hundreds of dollars compared to live instruction!

Six months free on-line support from live instructor via BBS included.

COURSES COVERED

- NetWare 3.1x Administration
- NetWare 3.1x Advanced Administration
- NetWare 3.1x Installation & Configuration
- NetWare 4 Update
- Service and Support
- Networking Technologies
- TCP/IP

REQUIRED ELECTIVE

United Education Centers
50 South Main, Pleasant Grove, UT 84062
801-785-7900 ext. 28

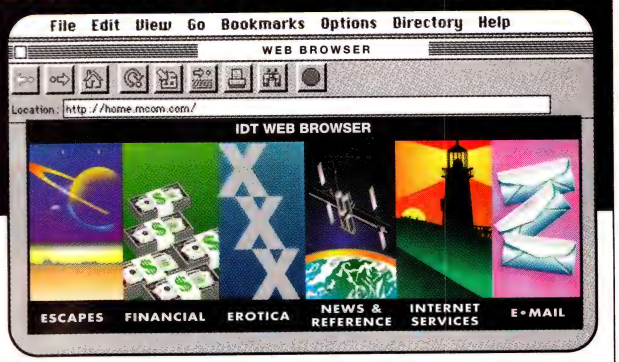
CALL 1-800-877-4889 ext. 28

Circle 224 on Inquiry Card.

TOTAL INTERNET ACCESS

$15 PER MONTH

UNLIMITED! UNCENSORED!



Why pay through the nose to access the Internet with those big, bland on-line services? (Especially since they censor what you can see and do.)

- IDT believes you have the right to unregulated & uncensored information & entertainment.
- For $15 monthly we deliver unlimited and uncensored usage with free customer support.
- We also provide free Netscape™ the ultimate WEB browser with every Slip/PPP account.
- Plus, it's always a local call.

To sign up / get information call:
1-800-743-4343

IDT

✓NO PER MINUTE CHARGES
✓ALWAYS A LOCAL CALL
✓UNLIMITED E-MAIL

CGM
for MS Windows

The Computer Graphics Metafile is the ISO/ANSI standard for the system independent storage of vector and raster based graphical information. Our Windows solutions give you easy access to this technology.

MetaPrint: The CGM printer driver for MS Windows. Is installed and functions as a standard MS Windows printer driver. MetaPrint gives you immediate **print to CGM** capability from any application that uses the GDI print function.

HSIview: The CGM interpreter for MS Windows. Views and prints CGM and WMF files and also translates CGM to/from WMF. HSIview was developed for Microsoft for use with Word, Powerpoint, etc. and is available as both an enduser application and a developer DLL.

Besides CGM, EMATEK supports other ISO/ANSI standards. Based on the Graphical Kernel System (GKS) and Computer Graphics Interface (CGI) standards our GSS graphic tools enable you to develop portable, device independent graphic applications. Call for an info pack today.

CGM-Standard
EMATEK

EMATEK GmbH
Subbelrather Straße 17
D-50823 Cologne, Germany
Phone: +49-221-512074
Fax: +49-221-529666
Email: gsscgi@ematek.de

Circle 215 on Inquiry Card.

Don't Be the Only One Using FORTRAN 77

You look around and discover everyone is making the move to LAHEY FORTRAN 90. Except you. You're using Fortran because it is proven, portable, and the best language for numerically intensive programs. But why 77? With Lahey Fortran 90, you can run your FORTRAN 77 programs FASTER and take advantage of the new language feature in 90.

Array expressions, more intrinsic functions, structures, pointers, better array handling, and modules are just a few of the reasons to move to Lahey Fortran 90. Use these and other features to build new, faster executing 32-BIT applications with fewer lines of code. But even if you are not writing new code, the design and speed of Lahey Fortran 90 are reasons enough to switch.

Lahey's innovative compiler design combined with Intel Corporation's highly OPTIMIZED code generation technology produces a language system optimized from the chip up. Lahey Fortran 90 is the fastest PC Fortran on the Pentium—over 18 Mflops on a 90 MHz (SP Linpack). And, you get all the TOOLS found in our award-winning (ahem) FORTRAN 77 language systems: editor, debugger, profiler, librarian, make, linker, video graphics, and Phar Laps's royalty-free DOS-Extender—everything you need to write or port 4GB programs. Add to this our decade of writing PC Fortrans and free technical support. So, don't be the last one using FORTRAN 77, make the move to Lahey Fortran 90.

$895

Call 800 548-4778 for more information on our Fortran language systems

Version 2.0 – Windows 3.x, 95, NT support, P6 optimizations, and more...

Lahey Computer Systems, Inc.

Competitive Upgrades

Fortran is our forte

702 831-2500 • Fax: 702 831-8123

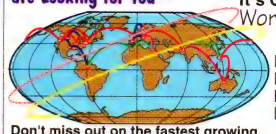
Circle 190 on Inquiry Card.

On-Line Services • Programming Languages/Tools

Fame & Fortune Awaits

Let Us Create Your WWW Home Page

40 Million Internet Users are Looking for You



Participate in the Evolving Global Economy
It's Growth Limiting to Miss the 'Net Wave'

World Wide Web Home Page Package

WWW Business Site Package, Turnkey Setup $249
24 hr Account $59 per month

- ☑ World-Wide Domain Name Registration
- ☑ Electronic Publishing Full Color Pages
- ☑ E-Mail World-Wide for About 5¢/min.
- ☑ Hypertext Your Brochures,Data Sheets
- ☑ Measure Customer Visits / Interest
- ☑ Music, Voice Messages Too

Individuals - Non Business WWW Package Setup $89 and Account $20 per month $89

Don't miss out on the fastest growing method of communication or advertising. Let the world know about you and your products or services.

Internet WWW Division
SiliconSoft®
www.siliconsoft.com on Internet or Call for Details
800-969-4411 Ph: 408-446-4521 Fax: 408-446-5196
5131 Moorpark Ave. #303, San Jose, CA 95129
Prices subject to change without notice SiliconSoft, Inc. © Corel

Circle 195 on Inquiry Card.

Programming Languages/Tools•Windows•Misc.

NEW!

Got *Fuzzy* Numbers?

12 26 240

Conventional spreadsheets can't cope with uncertain or fuzzy numbers.

But now there's *FuziCalc*. This Windows spreadsheet uses revolutionary fuzzy math technology to achieve breakthrough performance.

Call now for FREE information.

800-472-6183

FuziCalc®
The Fuzzy Spreadsheet™

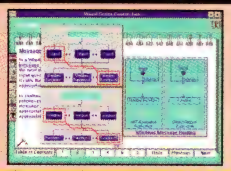
FuziWare®, Inc.
(615) 588-4144

Circle 216 on Inquiry Card.

Learn C++ & Windows™-Based Programming... *Simply, Quickly!*

With the OML Learning Series™ you can learn C/C++, object technology and Windows™-Based programming quickly and conveniently in the privacy of your home or office. The OML Learning Series features:

Visual Series™, C/C++ Series™ OOA/OOD Series™, OLE Series™



Call us for information, and FREE Demo Software

MONEY-BACK 30-DAY GUARANTEE

Visa MC Amex

Each series: **$249*** (reg. $400)
Any 2 series: **$399*** (reg. $750)
Any 3 series: **$549*** (reg. $1050)
All 4 series: **$649*** (reg. $1300)
LAN version: Call
* Limited Time Offer

800-6789-OML

OBJECT MANAGEMENT LABORATORY
TEL: 805-373-8111
FAX: 805-373-8116

Circle 217 on Inquiry Card.

Hurting your hands & wrists?
Try the traditional Chinese Hand Wrist Exerciser!

"Ding-Dong Balls"

ONLY **$9.95**

The Ding-Dong Balls are used by Chinese since hundreds years ago to strengthen the hand and wrist. Now, it's perfect for computer users to exercise their hands and wrists to prevent the hand-injury of long time using computer. The exercise can stimulate points on the fingers to help regulate the central nervous system, reduce stress and hypertension and provide therapy for arthritis of the wrist and fingers. It is also good for the senior people to strengthen their hand muscle and flexibility of fingers. *So, try it today, you don't need any skill to do it!*

VISA **CALL 1-800-928-3001** MasterCard

CATHAY-WAVE, INC. 2646 River Ave. Unit B, Rosemead, CA 91770
TEL: (818) 312-6911 FAX: (818) 312-6915

You Can Save Hundreds of Dollars With Only A $5 Investment GUARANTEED!

If you are looking to purchase a computer or computer-related product,
WE CAN TELL YOU WHO HAS THE LOWEST PRICE!

Computer Purchaser's Help Line is a research company that has been sourcing vendors for large corporate and government contractors for years. Now we are offering the same service to the public. We can give you access to vendors who normally do not sell to the public. If you have decided what product to buy, we can tell you who has the lowest price.

OUR GUARANTEE: **If you find a vendor who will sell you the same product for a lower price than the source we gave you, we will pay you $10!* You have nothing to lose! You just save $$$ on your purchases!**

Just imagine how much you can save on your next Computers, Printers, Memory, Fax/Modems, Hard Disk Drives, CD-ROM Drives, Multimedia Upgrades, Plotters, Digitizers, Software, Networking Products...

To Save on Your Next Purchase, Call: **(900) 9-SOURCE** Mon-Fri 9-5 PST (900) 976-8723 LIVE OPERATOR!

Our charges are only $4.99 for the first minute plus $1.99 for each additional minute. You can check on as many prices as you want with only one call.

Computer Purchaser's Help Line

All price guarantees are for 24 hours. The vendor who is offering you the lower price must sell nationwide and must offer the same price to everyone and have stock. You need to call us at (714) 852-8249 and give us the name of the vendor, phone number and your referral number. We will give you an approval number and mail you a check for $10.

THE BUYER'S MART

A DIRECTORY OF PRODUCTS AND SERVICES

THE BUYER'S MART is a unique classified section organized by product category to help readers locate suppliers. Each ad has Inquiry numbers to aid readers requesting information from advertisers.

AD FORMAT: Each ad will be designed and typeset by BYTE. Do NOT send logos or camera-ready artwork. Advertisers should furnish typewritten copy. **2"x1 1/16"** ads can include headline (23 characters maximum), descriptive text (300 characters is the maximum recommended) plus company name, address, telephone and fax number. **2"x2 5/8"** ad has more space for descriptive text (850 characters is the maximum recommended).

DEADLINE: Ad copy is due approximately 2 months prior to issue date. For example: November issue closes on September 8. Send your copy and payment to: THE BUYER'S MART, BYTE Magazine, 1 Phoenix Mill Lane, Peterborough, NH 03458. For more information call: Susan Monkton at 603-924-2618 FAX: 603-924-2683.

RATES (Jan. 1995)

		3-5 issues	6-11 issues	12 issues
2"x1 1/16"	1 ad	$731	$701	$614
	2 ads/issue	–	–	584
	3 ads/issue	–	–	556
2"x2 5/8"	1 ad	$1,462	$1,402	$1,228
	2 ads/issue	–	–	1,169
	3 ads/issue	–	–	1,111

••••••••COLOR – Add $100 ••••••••

ACCESSORIES

KEYBOARD, VIDEO, MOUSE, AUDIO
Extend signals from PC with **EXTENDER**
Split signals with **COMPANION/PC EXPANDER**
Switch signals among PCs with **COMMANDER**
Boosts signals up to 600 feet. Control up to 96 PCs with one keyboard, monitor and mouse.
CYBEX CORPORATION
4912 Research Dr., Huntsville, AL 35805
Phone: 205-430-4000 Fax: 205-430-4030

Inquiry 651.

STABILANT 22 CONTACT ENHANCER
"Highly recommended..." Jerry Pournelle
A long-term environmentally-safe, *resident* contact treatment; Stabilant 22 substantially improves the reliability of connectors and contacts for computers, bio-medical electronics, telecom, avionics, process control, CATV, video, audio, and automotive equipment.
D.W. Electrochemicals Ltd.
97 Newkirk Road (North) Unit 3, Richmond Hill, Ontario L4C 3G4, Canada (905) 508-7500

Inquiry 652.

SVGA Splitters
- Connect 2, 4, or more monitors to your computer
- Bright and crisp presentation simultaneously on all monitors - **Guaranteed**
- Works with all VGA, SVGA, and RGB monitors
- Supports 1280 x 1024 – **MADE IN USA**
- Special VGA extension cables to 250 ft

HALL RESEARCH Santa Ana, CA (714) 641-6607 **800-959-6439**

Inquiry 653.

BAR CODE

Bar Code Readers
For PC, XT, AT, PS/2, Macintosh and Serial Terminals
- ★ Attaches as 2nd Keyboard, no software changes
- ★ Reads 2of5, 128, UPC/EAN, Code 39, etc.
- ★ External or Internal attachment on PC
- ★ Wand, CCD, Slot Badge, Magstripe or Laser
- ★ Supports DOS, Novell, UNIX, Mac OS, etc.
- ★ 100+ Configurable Options
- ★ Supports USA & International Keyboards
- ★ 2 Year Warranty, 30 Day $$ Back Guarantee
- ★ Direct From Manufacturer
- ★ **Top Rated by Independent Review**
- ★ Complete with CCD Scanner – **$599**
- ★ Complete with Laser Scanner – **$655**
- ★ Complete Wand only Reader– **$329**

Worthington Data Solutions
3004 Mission Street • Santa Cruz, CA 95060 408-458-9938
800-345-4220

BAR CODE

Portable Reader
- ★ AA Battery Operated, 64K or 256K
- ★ Display messages and optional voice messages tell operator what to do. Messages are easily recorded (like answering machine) in any language. This unit is EASY!
- ★ Double duty as Non-portable Reader
- ★ 4x20 Supertwist LCD Display, 35 Rubber Keys
- ★ 2 Built-In Inventory Programs or create custom
- ★ Download tables and Pick Lists
- ★ Wand, CCD, or Laser Scanner Input
- ★ Serial Interface and Keyboard Interface
- ★ Reads 2of5, UPC/EAN, 128, Code 39, etc.
- ★ 2 year Warranty on Reader & Wand
- ★ 30 Day Money Back Guarantee
- ★ 64K Complete with Steel Wand – **$799**
- ★ **Small Size and very long battery life**

Worthington Data Solutions
3004 Mission Street • Santa Cruz, CA 95060
408-458-9938 FAX 408-458-9964 800-345-4220

Labeling Software
For DOS and WIndows with dot-matrix, LaserJet or DeskJet. Easy WYSIWYG design. Any format/size. Mix big text, bar codes, and PCX graphics. Formats for AIAG, KMart, Sears, MIL-STD, Penneys, WalMart. File Input. LabelRIGHT for DOS–**$279**. LabelRIGHT for WIndows–**$295**.
30 Day Money Back Guarantee
Worthington Data Solutions
(408) 458-9938 800-345-4220

RF Terminal
Communicates 2 way to Serial Base Station from 150-600 ft. Relay units extend range to 4000 ft. 1-16 terminals per base station. Keyboard, wand, CCD or laser scanner input. 16 Selectable frequencies. Small size and low weight – 12 oz. with batteries. Base Station – **$795.** Terminal – **$1095.**
Worthington Data Solutions
(408) 458-9938 (800) 345-4220

Windows Bar Code Fonts
Add bar codes to any font based Windows program. Fonts designed for dot matrix, DeskJet and LaserJet. Print Codabar, 2 of 5, Code 128, UPC/EAN and Code 39 inside your Windows program. TrueType fonts, bitmaps and metafile support included. Only **$199.**
Worthington Data Solutions
(408) 458-9938 (800) 345-4220

BAR CODE

Portable Bar Code Reader
- ➤ Use as a PORTABLE, WEDGE, or SERIAL
- ➤ 9V Battery Operation with Lithium Backup
- ➤ 2x16 Supertwist LCD Display
- ➤ 54 Key Keyboard with Separate Numeric Keys
- ➤ Real-time Clock Supports Date & Time Stamps
- ➤ Reads all Popular Bar Codes (16 types)
- ➤ Wand, CCD, Laser, or Serial Input Devices
- ➤ Built-In Program Generator
- ➤ Create Your Own Custom Programs
- ➤ 6 Built-In Inventory Programs
- ➤ Up to 250 Programs Can Reside in Memory
- ➤ Create up to 250 Data Files per Program
- ➤ Up to 250 Look-Up Files in Memory
- ➤ Built-In Calculator
- ➤ Supports HAYES Compatible Modems
- ➤ 64K Memory with Data Compression
- ➤ 30-day $$ Back Guarantee – 1 Year Warranty
- ➤ Complete Unit with WAND Scanner – $795

AMERICAN MICROSYSTEMS
2190 Regal Parkway, Euless, TX 76040
(800) 648-4452 (817) 571-9015 FAX (817) 685-6232

BAR CODE READERS
For PC, XT, AT, PS/2, & Serial Terminals
- ➤ Emulates Keyboard: Works With Any Software
- ➤ Data Appears as Keyboard Input
- ➤ Uses Enhanced Decoding Algorithms
- ➤ Accepts Wand, Slot/Badge, CCD, Laser, Magnetic Stripe Reader, & RS232 Serial Input
- ➤ Reads All Popular Bar Codes (16 types)
- ➤ Reads HIGH, MEDIUM, & LOW density codes
- ➤ Auto-Discriminates Between Bar Code Types
- ➤ Easily Programmed with a Bar Code Menu
- ➤ Over 140 User Configurable Options
- ➤ Daisy Chain Up to 96 Readers
- ➤ Supports NOVELL Networks
- ➤ Supports US & INTERNATIONAL Keyboards
- ➤ Direct From Manufacturer
- ➤ 30-day $$ Back Guarantee, 1 Year Warranty
- ➤ Complete Unit with LASER Scanner – $645
- ➤ Complete Unit with WAND Scanner – $299

AMERICAN MICROSYSTEMS
2190 Regal Parkway, Euless, TX 76040
(800) 648-4452 (817) 571-9015 FAX (817) 685-6232

Bar Code Library DLL
Bar Code Library sends bar codes to the display, Windows clipboard, bitmap file, or printer. Bar Code Library supports most applications with a built-in programming language that can call a DLL. $349
StrandWare, Inc.
715-833-2331 Fax: 715-833-1995
800-552-2331 (in US)

Inquiry 654.

THE BUYER'S MART

BAR CODE

Bar Code Printing Software
LabelWorks for Windows

- Prints all Popular Bar Code Types (19 Types)
- Desktop Publishing Features: WYSIWYG, Scalable Fonts, Rulers, Guides, Lines, Shapes, Page Zooms (25%-400%), Templates
- Rotates Text, Bar Codes, and Graphics
- Supports Windows Compatible Fonts
- Choose From Over One Hundred Popular Label Formats or Design Your Own
- Rich Text Support: Mix Styles, Types, & Sizes
- Automatically Prints Serial Numbers
- Imports & Exports Graphic Files: TIFF, GIFF, BMP, PCX, WPG, WMF, TARGA
- Supports Virtually all Windows Compatible Printers (PostScript, Laser, & Dot Matrix)
- 30-day Money-Back Guarantee, $295

CALL FOR FREE DEMO SOFTWARE

AMERICAN MICROSYSTEMS
2190 Regal Parkway, Euless, TX 76040
(800) 648-4452 (817) 571-9015 FAX (817) 685-6232

BARCODE & MAG. STRIPE SYSTEMS

- **Keyboard Wedge** with **HP** Stainless Steel Wand/Mag. Stripe Reader $249
- **Keyboard Wedge** with **SYMBOL LS2000** or **SP400** Laser & Mag. Stripe Reader $849
- **Keyboard Wedge** with **PSC QuickScan** Laser/Mag. Stripe Reader $699
- **Software Wedge Decoder** with HP Stainless Steel Wand or Laser Scanner (DOS & WIN - RS-232 or parallel) $189 +
- All **Wedge Packages** include a Wand or Laser Holder
- **Mag. Stripe Encoder/Reader** (3 Trks) w/Software $1299
- **Printing Software** (DOS, WIN, UNIX...) $149 +
- **Portable Data Terminals** (128K– 4.2MB) $599 +
- **Complete POS System:** 486 40Mhz, $1999
  4MB RAM, monitor, POS Software, SP212 Receipt Printer, M–S Cash Drawer, pole display, HP stainless steel wand and magnetic stripe reader wtih decoder
- **Application Software:** Inven, Asset, Tools, Time & Attend....
- **Radio Frequency** Terminals (spread spectrum/narrow band)
- Bar Code Printing Software (DOS) included with each purchase
- Made in the USA • 30 Day $$ Back • Spanish Dept. Avail. • Direct from Mfg.

BARCODE INTERNATIONAL SYSTEMS (BIS)
12140 Severn Way, Riverside, CA 92503 (909) 270-0016 Int'l
(800)653-4252 US • (800) 219-5178 CAN • FAX (909) 270-0920

Inquiry 655.

CAD

Circuit Design Software for Windows
Easy-to-use schematic entry, PCB design, and simulation software, starting at $149 each. Complete PCB package with schematics, autorouter, and layout for 2-layer circuit boards, $399. Enhanced version with autoplacement, more symbol libraries, and up to 16 layers, $649. CAM file outputs.

Mental Automation, Inc.
5415 136th Place, SE-Bellevue WA 98006
(206) 641-2141 FAX (206) 649-0767 BBS (206) 641-2846

Inquiry 656.

CAD/CAM

CONTOURING MOTION CONTROL
FROM A PRINTER PORT!
Indexer LPT™ software
NEW **VERSION 3** $249 VISA/MC

- Controls up to six step motors simultaneously.
- Linear and Circular Interpolation.
- New features to accommodate machine control.
- Easy-to-use DOS device driver. Super Manual.
- CAD-CAM interface available.

Ability Systems Corporation, 1422 Arnold Ave. Roslyn, PA 19001 (215) 657-4338 FAX: (215) 657-7815

Inquiry 657.

CAD/CAM

One-Step conversion of optical templates to NC!
Extremely simple & powerful this *Fast*COPY® DOS software is packaged *with* a 42"x60" GTCO Super LII digitizer & 16 button cursor for $4,995

Call *Fast*CAM at: (970) 667-5059
or FAX: (970) 667-1990
Ft. Collins, Colorado, U.S.A.

Inquiry 658.

CD-ROM

We Buy, Sell & Trade
CD-ROMS & MEMORY CHIPS
Resellers Wanted
Call or write for a free product update
Consolidated CDROM Inc
102 Greenwood Ave, Wyncote PA 19095 USA
+1-215-572-9831 / +1-215-572-9832 fax
1-800-8-CDROMS

Inquiry 659.

INTERNET on CDROM!

GAMES for DAZE 2 CD Set $30
X2FTP Archive, hundreds of games & demos!
WORLD WIDE WEB Catalog on CD-ROM $30
See the Web without being on-line!
LINUX Developers Resource 4 CD Set $25
Complete OS, Source Code Slackware & more!
MOO-TIFF CD-ROM $99
Complete development sys, 100% OSF/Motif
INTERNET Tools CD-ROM $30
Networking tools & utilities for DOS & UNIX
BSDisc (NetBSD & FreeBSD) $35
Ready to use formats with install scripts
USENET 2 CD Set $25
comp.sources & alt. sources + many FAQ's from other groups
SOURCE CODE CD-ROM $30
4.4 BSD-Lite, XIIR6, MACH, Andrew Windowing
PERL & TCL/TK CD-ROM $35
Utility lang + command lang & toolkit for X-Windows
STANDARDS 2 CD Set $30
RFC's, IEN's, CCITT/ITU Bluebook, Windows Sockets

MC, VISA & AMEX **1-800-800-6613**
tel: +1-520-526-9565
InfoMagic fax: +1-520-526-9573
P.O. Box 30370, Flagstaff, AZ 86003-0370 info@infomagic.com

Inquiry 660.

CD ROM TOWERS & JUKEBOX SERVERS FOR ALL OPERATING SYSTEMS!

No Device Drivers/ MSCDEX needed,
Complete Kit Networks CD Roms,
unlimited user license, DISCPORT.
"JES, NONE BETTER AT ANY PRICE"
Call NOW: 1 (800) 482-1866 305-597-3980

Inquiry 661.

COMMUNICATIONS

Frame Relay, X.25, BSC, HDLC, SDLC, PPP
Rock solid, compliant, inexpensive and robust PC APIs and router implementations. On board protocol support reduces PC overhead.

- For MS-DOS, Windows, Win NT, Unix, OS/2, Netware and others.
- Routers interconnect any PC systems or LANs.
- Cards for 56kbps to T1/E1.
- Powerful management and test utilities.

Sangoma Technologies Inc.
(800)-388-2475 • (905)-474-1990 • Fax: (905)-474-9223
E-Mail: dm@sangoma.com • Web: www.sangoma.com

CD-ROM

WALNUT CREEK CDROM

Cica MS Windows. 4000+ Windows programs, games, drivers, fonts, shells, src. Quarterly updates **$29.95**
Hobbes OS/2. 600 MB current Free & Shareware drivers, app's, etc. **OS/2 Mag**'s product of the year! **$29.95**
Slackware Linux. 2 disc *OFFICIAL* Slackware 2.3. Internet's favorite. Quarterly updates **$39.95**
FreeBSD. Rock solid Berkeley Unix for PC w/src **$39.95**
Simtel MSDOS. 2 discs, premier Free/Shareware **$34.95**
Ready-to-Run Hobbes. Installed emacs, GCC **$39.95**
Source Code. 650 MB mostly C. UNIX & DOS **$39.95**
Internet Info. 17,000 doc's. FAQs, FRCs, & IENs **$39.95**
Ada. 2 discs: Ada compilers tons of src & docs **$39.95**
Nebula for NEXTSTEP. 650 MB Quad-Fat programs **$59.95**
Scientific Library. Technical shareware. DOS/Win **$39.95**
Space and Astronomy. 1000's NASA images & data **$39.95**
C Users' Group Library. C source code & articles. **$49.95**
POV-Ray. Ray-tracing images, src, documentation **$39.95**
CDROM Caddies. Lifetime Guarantee **$4.95**

All our products are unconditionally guaranteed!
1-800-786-9907
4041 Pike Lane, Ste D-213, Concord, CA 94520
+1-510-674-0783 Visa/MC/AMEx, Fax: +1-510-674-0821
orders@cdrom.com http://www.cdrom.com/

Inquiry 662.

COMPUTER BOOKS

COMPUTER PROFESSIONALS
Easy online searching and ordering at our online stores. Computer books from 300+ publishers. On the Web, http://www.compubooks.com/books.html. CompuServe, GO CBK. NIFTY-Serve, Go WSN. Worldwide shipping by UPS or USPO. Our catalogs are online at ftp.compubooks.com/pub/books.
CompuBooks℠ Online Bookstores
512-321-9652 Fax 512-321-4525 800-880-6818

COMPUTER INSURANCE

INSURES YOUR COMPUTER
SAFEWARE Computerowner's coverage provides replacement of hardware, media and purchased software. As little as $49 a year covers accidents, theft, power surges and more. One call does it all.
1-800-800-1492
SAFEWARE, The Insurance Agency Inc.
PO Box 02211, 2929 N. High St., Columbus, OH 43202
Now available in Ontario!!!

Inquiry 663.

COMPUTER MEMORY

WE'LL PAY YOU FOR YOUR OLD MEMORY
Simms, Dips, Laser Printer, 1 Megx9, 4 Megx9, DRam Chips
— ANY MEMORY —
All Memory Has Value! Don't let your old memory collect dust
Call or fax what you have available
1-800-718-7755
THE MEMORY LIQUIDATORS
"The company that buys memory back"
531 Main St., Ste. 1174, El Segundo, CA 90245-3060
Ph. 310-676-3074 Fax 310-676-3076

CROSS ASSEMBLERS

PC BASED DEVELOPMENT TOOLS
We offer low-cost efficient **CROSS ASSEMBLERS** and a superb line of **SIMULATOR-DEBUGGERS** with full built-in **DISASSEMBLERS** for Intel's **MCS-48, 51, 85** and **96**, and for the **Z80** families of embedded controllers. Our new simulators for the **80C196KB** and **80C196KC** are unique in the market, and have been received with rave reviews. The price of our software includes unlimited free upgrade privileges!
Lear Com Company
2440 Kipling St., Ste. 206, Lakewood, CO 80215
(303) 232-2226 FAX (303) 232-8721

Inquiry 664.

DATA RECOVERY

We Can Save It!
All Platforms - All Storage Devices
Proprietary techniques so advanced we rescue data others simply abandon.
DRIVESAVERS
Restoring data since 1985
1-800-440-1904
415-883-4232

Inquiry 665.

The Leader in Data Recovery
- Expertise in virtually every operating system & media storage device.
- 24-Hour support & emergency services available.
- Call for a FREE consultation!

ONTRACK DATA RECOVERY
MN: 1-800-872-2599 • CA: 1-800-752-7557
DC: 1-800-650-2410 • Europe: +44 (0)181 974 5522

Inquiry 666.

DATA/DISK CONVERSION

THE #1 CHOICE
in disk & tape conversion
for many leading corporations, government agencies, law firms, and companies in every industry–world-wide.
Free test • Satisfaction guaranteed
Graphics Unlimited Inc.
3000 Second St. North, Minneapolis, MN 55411
(612) 588-7571 FAX: (612) 588-8783
1-800-745-7571

Inquiry 667.

CONVERSION SERVICES
Convert any 9-track magnetic tape to or from over 6000 formats including 3½", 5¼", 8" disk formats & word processors. Disk-to-disk conversions also available. Introducing CD-ROM conversions. Call for more info.
Pivar Computing Services, Inc.
165 Arlington Hgts. Rd., Dept. #B, Buffalo Grove, IL 60089
(800) Convert **(708) 459-6010**

WE WROTE THE BOOK!
Deal *direct* with the company who developed the systems that most others use... **SHAFFSTALL!** Tape/Diskette Transfer/Conversion/Duplication. PC/Mini/Mainframe/Workstation Tape Transfer. WP to WP Document Conversion Services.
1-800-357-6250 317-842-2077
Shaffstall Corporation (Fax) 317-842-8294

Inquiry 668.

EDUCATION

B.S. & M.S. In COMPUTER SCIENCE
The American Institute for Computer Sciences offers an in-depth home study program to earn your Bachelor of Science at home. B.S. subjects covered are: MS/DOS, BASIC, PASCAL, C, C++, Data File Processing, Data Structures & Operating Systems. M.S. program includes subjects in Software Engineering and Artificial Intelligence. Ada and Using Windows courses also available. Accredited Member: World Association of Universities and Colleges.
AMERICAN INST. for COMPUTER SCIENCES
2101-BY Magnolia Ave. , Suite 200, Birmingham, AL 35205
1-800-767-2427 • 1-205-323-6191

FLOPPY DISKETTE

3.5˝ FLOPPY DISK
RELIABLE & DURABLE
- We are a manufacturer licensed by Sony Corporation.
- Our disks are all 100% Tested and Certified Error Free with guaranteed Clipping Level.
- Available products: 2HD, 2DD, video tape, CD jewelry box.
- Our own brand MEGA, OEM or bulk pack are also available.
- Duplicators & wholesalers are welcome.

YHC Cassette Ind. Ltd.
75 Saintsbury Square
Scarborough, Ont.
M1V 3K1 Canada
Tel: (416) 321-1179
Fax: (416) 321-8451

INMARK IND. LTD.
1A Man Foong Industrial Bldg.
7 Cheung Lee Street,
Chai Wan, Hong Kong
Tel: (8522) 5582203
Fax: (8522) 8973700

Inquiry 669.

FLOW CHARTS

COBOL STRUCTURE CHARTS
The *new* PowerStructure for Windows generates incredible structure charts **DIRECTLY** from your COBOL source – **STRUCTURED or NOT!** Forget manual flowcharting. PowerStructure will diagram your spaghetti code, do it in seconds, and free programmers for more important work.
Now just $149.
CyberMetrics
5541 S. Marine Drive., Tempe, AZ 85283
(602) 838-3310

Inquiry 670.

WINDOWS FLOWCHARTER $129
RFFlow 3.0 is a professional drawing tool for flowcharts & org. charts. Requires Microsoft Windows; 500 shapes auto adjust in size; diagonal lines and curves; auto line routing and re-routing; OLE server; click on a shape to bring up a sub-chart; import/export bitmaps and metafiles; Call for free trial disk.
RFF ELECTRONICS
1053 Banyan Court, Loveland, CO 80538
Phone: (970) 663-5767 **FAX: (970) 669-4889**

FOREIGN LANGUAGES

OVER 150 LANGUAGES
Translation, Language Learning Tutorials, Fonts, Dictionaries and Language Systems for DOS, Mac and Windows. Japanese, Chinese, Spanish speaking staff. Call us first for best prices and expert support.
Character Language Resources
2130 Sawtelle Blvd. 304A, Los Angeles, CA 90025
800-569-2099 FAX 310-996-2303

Inquiry 671.

FORTRAN

LS FORTRAN for Power Macintosh
★ ANSI standard FORTRAN 77 compiler
★ Built-in diagnostics and source level debugging
★ Mainframe extensions (VAX, Data General, Cray)
★ Optimized code generation for any Macintosh
★ Up to 29 mflops (SLinpack)
Language Systems Corporation
(800) 252-6479 100 Carpenter Dr.
(703) 689-9593 Fax Sterling, VA 20164

Inquiry 672.

HARDWARE

Pre-Owned Electronics, Inc™
THE Independent Provider, serving the Dealer, Professional, Corporate, Government, and Educational Buyer since 1985.
APPLE® II & MACINTOSH®
SYSTEMS • PARTS • EXCHANGE REPAIRS
Call for a Catalog... **800-274-5343**
INT'L: 617-275-4600 • FAX: 617-275-4848
205 BURLINGTON ROAD • BEDFORD, MA 01730

Inquiry 673.

HARDWARE

HEWLETT-PACKARD
Buy – Sell – Trade

LaserJet	ColorPro
DeskJet	DraftPro
RuggedWriter	DraftMaster
Electrostatic Plotters	DesignJet

HP 9000 Workstations and Vectras also available.
Ted Dasher & Associates
4117 Second Ave., S. Birmingham, AL 35222
Phone: (205) 591-4747 Fax: (205) 591-1108
(800) 638-4833 **E-mail : sales@dasher.com**

Inquiry 674.

LANS

Little Big LAN
The most flexible network
- Peer to Peer LAN to 250 nodes
- $75 total software cost, not per node!
- Link via serial, parallel, or Modems
- Also via Ethernet or Arcnet, or mix!
- Typically only 40k of RAM

Information Modes
817-387-3339 / P.O. Drawer F, Denton TX 76202
Fax 817-382-7407 Orders 800-628-7992

Inquiry 675.

MANUFACTURING SOFTWARE

Manufacturing Software
E-Z-MRP™ is complete material requirements planning software for the PC. Includes bill of materials, material planning make/buy calculation, capacity planning, purchase orders, labor distribution, job costing, physical inventory, AutoCAD interface, and more. The best entry-level manufacturing solution. Complete for $2,995. Special Lite version for $995. Call for information.
Alliance Manufacturing Software
1-800-490-2520

PROGRAMMERS TOOLS

The Fastest xBASE Engine
CodeBase provides C, C++, Visual Basic and Delphi programmers with the *fastest* xBASE compatible database engine. Get multi-user compatibility with FoxPro, Clipper and dBASE files. And it's *portable* from DOS to Windows to UNIX!
FREE 30 day trial
Call Sequiter Software Inc. for details!
Phone 403-437-2410 FAX 403-436-2999

Inquiry 676.

SECURITY

Leaders in Software Security
EVERLOCK and **EVERKEY II** copy protection. Features include – Encryption, Serialization, Remotely resettable access flags, date limits, execution counts and network user limits - and much more! Free demo available.
Call today and ask about our low cost Trial Kits!
Az-Tech Software, Inc.
201 East Franklin St., Richmond, MO 64085-1883
(800) 227-0644 (816) 776-2700 FAX (816) 776-8398

Inquiry 677.

THE ULTIMATE SOFTWARE SECURITY
- STOPCOPY family – UNCOPIABLE copy protection
- STOPVIEW software encryption
- NETLIMIT network license metering
- DOS, Windows, Macintosh, OS/2, support
- No source code changes required - for ANY of our products in ANY environment
- Our products destroy ALL of our competition
- Call for FREE demo disk, or to discuss our products' MANY options

BBI Computer Systems, Inc.
14105 Heritage Lane, Silver Spring, MD 20906
800/TRY-ABBI • 800/879-2224 • 301/871-1094 • FAX:301/460-7545

Inquiry 678.

THE BUYER'S MART

SECURITY

CRYPKEY SOFTWARE LICENSING SYSTEM

"Software Copy Protection with **NO** Hardware Key and **NO** Disk Key"

CrypKey is **software copy protection** that is

- completely secure from any disk copy program
- completely compatible with MSDOS, MS WINDOWS, WIN 95, WIN NT
- completely compatible with CD-ROM, BBS, or Internet distribution!
- customer friendly – no disk key, no hardware key, less support calls

CrypKey can **increase your software sales** by allowing you to sell your program

- by increments – sell add-on software options or levels to your customers
- by number of runs – e.g. sell 100 calculations for $100.00
- by time period – e.g. lease or demo your program for 60 days

CrypKey uses a numeric key that can be transmitted by phone, fax, or email. Sell your customers more options, more copies, more time or more runs instantly, just by making a telephone call (great for overseas customers or distributors). CrypKey is produced by Kenonic Controls Ltd. – engineering and software since 1972.

Kenonic Controls Limited
7175–12th Street South East
Calgary, Alberta, Canada T2H 2S6
(403) 258-6200 • fax: (403) 258-6201
INTERNET: crypkey@kenonic.com

Inquiry 679.

Cop's CopyLock II

Professional software protection with TRUE Machine Install. Option Board safe. DOS, OS2, Networks, Windows, Trace 3000. **DialCOPS** Access Control for mass distribution via CD-ROM or Internet. Known and used world-wide since 1984.

LINK Data Security
Int'l: + 45 3123-2350 Fax: + 45 3123-8448

KEY-LOK™ SECURITY

Software Piracy Prevention — Survival 13 years proves effectiveness of powerful multilayered security. Algorithmic response, programmable memory, counters, lease control, remote update. DOS/WINDOWS/NT/WINDOWS95/UNIX. Low pricing ($13.95/1000, $18.95/100, $21.95/50, $24.95/25, $29.95/10, $37.95/2). No startup costs. No ID on devices. Also, ACCESS CONTROL systems and disk drive/system LOCKS.

MICROCOMPUTER APPLICATIONS
3167 E. Otero Circle, Littleton, CO 80122
1-800-4KEY-LOK (303) 770-1917 FAX: (303) 770-1863

Inquiry 680.

SOFTWARE PACKAGING

FREE SOFTWARE PACKAGING CATALOG

Everything you will need to Package, Distribute, and Ship Your Software!! From manuals and binders to mailers and shippers.

LABELS • LABELS • LABELS
For your diskettes, plain or custom printed dot matrix or laser printer ... free samples

•••FREE CATALOG•••
Hice & Associates
8586 Monticello Dr., West Chester. OH 45069
Phone/Fax: 513-779-7977

Inquiry 681.

SOFTWARE/BUSINESS

DATA ENTRY SOFTWARE

Full featured, heads-down data entry with two-pass verification, edit language, operator stats, batch control, on-line help, output record reformat, free tech support.

For the PC, PC LAN, S/36, AS/400.

FREE 30 day trial

Computer Keyes	Tel:	206-776-6443
21929 Makah Rd.,	Fax:	206-776-7210
Woodway, WA 98020	USA:	800-356-0203

SOFTWARE/ENGINEERING

Analog/Digital Simulation!!

- **Windows, NT, DOS**
- **Power Mac, Macintosh**
- **IsSpice4 Real Time SPICE**
- **Mixed Mode Simulation**
- **Schematic Entry**
- **New AHDL Modeling Kit!!**
- **Model Libraries, RF, Power**
- **More Than 5000 parts**
- **Waveform Analysis**
- **Full SPICE programs starting at $95. Complete systems, $595-$2595**

P.O. Box 710 San Pedro, CA 90733-0710
(310)833-0710, FAX (310)833-9658 ***intusoft***
Call for your Free Demo and information kit.

Inquiry 682.

FIT DATA EFFORTLESSLY!

Magestic™ – Outstanding, flexible fitting from within MS Excel. Handles large models, multiple functions simultaneously, arbitrary numbers of parameters, numerical or user-supplied derivatives, automatic sequences. Plus Monte Carlo global minimization, DLL interface for huge/complex models. $295

Logix Con. Inc. 1-800-900-5541
Check us on the web: http://www.lgx.com

Inquiry 683.

EXPERIMENTAL DATA FITTING

SCIENTIST™ is the leader in experimental data fitting. Fit combinations of user-defined algebraic and differential equations or Laplace transforms – also splines and interpolating functions. Includes 3D plotting and a scientific worksheet. Requires Windows. $395. Model libraries also available.

MicroMath Scientific Software
1-800-942-6284 Fax: (801) 943-0299

Inquiry 684.

SAUNA: 3D THERMAL ANALYSIS

● Models: PCBs, stacked plates, heatsinks, multiboard enclosures. ● All heat transfer modes: convection, radiation, conduction ● Interactive menu-driven ● Thermal parameters library ● Fast "What if": dimension, mat'l, finish, analyses ● Easy to learn & use ● IBM PC & Macintosh II

Call or FAX for free evaluation program

Tatum Labs, Inc.
1287 N. Silo Ridge Drive, Ann Arbor, MI 48108
313-663-8810 FAX 313-663-3640

Inquiry 685.

SOFTWARE/GRAPHICS

New Version!
AccuSoft Image Format Library 5.0

Programmers: *Add support for 36 raster file formats instantly!*

TIFF, JPEG, PCX, TARGA, DIB, DCX, GIF, BMP, WMF, PICT, WPG, EPS, Group 3, Group 4
New Formats: Photo CD, PhotoShop, ASCII, KoFax, RLE, LaserData, CALS, ATT, CLP, XWD, IMG, IFF, SUN, XBM, ICO, IOCA, CX2, XPM, CUT, Brooktrout, MAC, MSP.

Guaranteed to read all raster images in existence in the listed formats!

- ✲ Import, export, scanning, conversion, compression
- ✲ Printing, display, image processing
- ✲ Supports all languages
- ✲ Fax formats and multi-page images
- ✲ Rotate, zoom, scale, color reduction
- ✲ Thumbnails, sharpen, special-effects
- ✲ Windows, NT, WinPro Gold 32, VBX, VBX32
- ✲ Watcom, OS/2, MAC, UNIX, Clipper, FoxPro

AccuSoft Corp. Call 800-525-3577
Two Westborough Business Park Westborough, MA 01581 USA
TEL (508) 898-2770 FAX (508) 898-9662

Inquiry 686.

SOFTWARE/GRAPHICS

Autodesk's DWG OEM

- Programmers' Toolkit to Read/Write AutoCAD DWG & DXF Files.
- Object oriented, modular, database-like access to CAD data.
- View, Print, Plot and Pick Modules.
- Available for C/C++ for DOS, X-DOS, Windows, Sun, and other Unix systems.

Autodesk OEM Sales
1301 Marina Village Parkway, Alameda, CA 94501
Phone: (510) 337-7203 Fax: (510) 523-2880

Inquiry 687.

DbCAD dev 1.3 DLLs

Create, select, edit, import (DXF, DWG), all the AutoCAD 2D vector entities, in a graphics database (DBF). Display raster images (RLC, RLE, BMP) on which you can overlay vector drawings (DWG, WMF, graphic DBF). Manage a graphic window (pan, zoom, overview, pick). Print by using Windows driver and fonts.

Channel inc. U.S.A.
+617-863-0068

Inquiry 688.

CAD Developers Kit

TG-CAD Professional 5.5, a 'C' Win/DOS SDK. Read/Write/View PCX/GIF files & DXF to R12. Create fonts & text. Ray Tracing & Shading. Hundreds of 2D & 3D routines. Comes as DOS Lib., Win Lib. & Win DLL. Source available. Free Technical White Paper available. Call or write today.

Disk Software, Inc., Box 941152
Plano, TX USA 75094-1152
800-635-7760, Fax 214-423-7288

Inquiry 689.

"LEADTOOLS does image manipulation and does it right!" BYTE Magazine, 2/95

Discover what Kodak, Corel, Delrina and over 2500 developers, publishers and OEMs already know: LEAD offers the fastest and most complete image compression and manipulation SDK on the market.

Three Toolkits In One!

Introducing LEADTOOLS version 5, offering three toolkits for the price of one: 1) image format support, conversion and compression, 2) image processing and, 3) all NEW BITONAL toolkit. Includes royalty-free runtime, virtual memory management for unlimited image size, free technical support, online help, sample programs with source code, over 40 image processing functions, and CMP, the virtually lossless image compression format.

Call today for FREE imaging application built with LEADTOOLS 5!

800-637-1835

LEAD TECHNOLOGIES INCORPORATED

900 Baxter Street • Charlotte, NC 28204 • 704-332-5532 Fax: 704-372-8161

Inquiry 690.

SOFTWARE/MATHEMATICS

ORSYS – $299
OPERATIONS RESEARCH SYSTEM

- Linear programs up to 3000 by 15000
- Mixed-integer and discrete linear programs
- Nonlinear objective and quadratic programs
- Transportation and Transshipment models

Eastern Software Products, Inc.
P.O. Box 15328, Alexandria, VA 22309
(703) 360-7600 Fax (703) 360-7654

Inquiry 691.

SOFTWARE/SCIENTIFIC

VTEX Scientific Desktop Publishing

- Scalable Fonts • Font effects • Typeface customization
- Equations • Tables • Graphics • Foreign languages
- Multi-lingual spell & hyphenation • IDE • On-line help
- Dos, Dos-32 and Windows versions • From $199

"TEX of Tomorrow"–Notices of AMS, March 1991

Call now for a ***FREE DEMO DISK***

MicroPress, Inc.

68-30 Harrow Street, Forest Hills, NY 11375

Tel (718) 575-1816 Fax (718) 575-8038

Inquiry 692.

SOFTWARE/SECURITY

Lock Out Pirates! Lock in Profits!

Marx CRYPTO-BOX – The most effective protection against software piracy you can buy: Programmable microprocessor • 1,000,000 read/write operations • Program ID codes without special equipment • Integrated Crypt Algorithm • DOS, WINDOWS, or OS/2 Compatibility • Perfect transparency.

Marx International, Inc.

1-800-MARX INT

(404) 321-3020 FAX (404) 321-0760

Germany: 8403 1555 France: 8881 4031

Inquiry 693.

SOFTWARE/VOICE/FAX

Computer Telephony 'C' Libraries

Multi-Voice V4.0 and Multi-Fax V2.0 Toolkits give you the most powerful solution to integrate telephony to your 'C' applications.Unique design based on multi-tasking; DOS Extender; Supports most major voice and fax boards; Commented source code; Royalty free; Best value. Also available: Windows based application generator.

ITI SOFTWARE

Tel: 514-835-3124 Fax: 514-835-4772 BBS: 514-835-5945

Fax-On-Demand: 514-835-2216, E-mail: ggagnon@cam.org

Check our home page: http://www.cam.org/~ggagnon

UNIX FOR PCS

LINUX RELEASE 1.1

32 bit Unix compatible OS for 386, 486, 586's

Includes C, C++, Obj. C, Pascal, smalltalk, Perl.X11 R6, TCP/IP, UUCP, PPP, Slip, NFS, VI, emacs, Openlook, plus much more. Supports: SCSI, IDE, ESDI, MFM, VGA, S3, CGA, CD-Rom, Soundblaster, full man pages, 600 pg. manual included. "Full Internet support" $59.95 on CD-ROM, $69.95 on disks, Dr. Linus Book $49.95.

Linux Systems Labs, 49884 Miller Ct. Chesterfield, MI 48047 (800) 954-2938, (810) 716-1700, fax (810) 716-1703

Inquiry 694.

VIDEO CAPTURE

Capture with Digital Fotovix

Tamron's IIIS-D captures 35 mm film in under 10 seconds. Database images, add them into your multimedia presentations or make your own product catalogues. Modem images to clients or capture for FPO purposes. Grab other video sources through IIIS-D's S-video input. Photoshop Plug-in and driver software included.

Tamron Industries

99 Seaview Blvd., Port Washington, NY 11050

516-484-8880

Inquiry 695.

WINDOWS

***FREE INTERNET**

217-322-1111

Full Access 14.4K 8/N/1 All Nodes

Service is FREE *You Pay L.D. Charge

Voice Help 1-217-322-1212

Inquiry 696.

WINDOWS

THE ULTIMATE BBS

FREE FREE FREE FREE FREE FREE FREE

Latest Windows and DOS Utils, Pgms, Source Code, Lively CHAT, online games, Internet Access and more and all FREE. Call from home or office up to 14.4K and download for FREE. (n/8/1)

217-792-3663

Customer Service 415-281-4429

Inquiry 697.

ADD IMPACT WITH

COLOR

IN THE BUYER'S MART!!

Attract the attention of your customers with the addition of color to your ad.

Call

Susan Monkton

603-924-2618

for rates and details

Fax 603-924-2683

Inquiry 698.

Something Missing?

Complete your BYTE collection by ordering Back Issues today!

	1992	1993	1994	1995
January				
February				
March				
April				
May				
June				
July				
August				
September				
October				
November				
December				
Special Issues	Windows '92 Portability '92	Windows '93 B Guide Summer 93		

Special Issues U.S. Delivery $3.00 Foreign $4.00
1990-Present U.S. Delivery $6.50 Foreign $8.50 Canada & Mexico $7.00
All issues prior to 1990 U.S. Delivery $3.00 Foreign $4.00

All checks must be in U.S. funds and drawn on a U.S. bank.

The above prices include postage in the US.

Please indicate which issues you would like by checking(√) the boxes. Send requests with payment to:

BYTE Back Issues, One Phoenix Mill Lane, Peterborough, N.H. 03458, (603) 924-9281

Charge: ☐ MasterCard ☐ VISA ☐ American Express

Card #_____

Exp. Date_____

Signature_____

Name _____

Address_____

City_____

State_____ Zip _____

BYTE Because the *Experts* decide.

All orders must be prepaid. Please allow four weeks delivery.

ADVERTISER CONTACT INFORMATION

To order products or request FREE information, call advertisers directly or send in the response card by mail or fax! ***Let them know you saw it in BYTE!***

Inquiry No.		Page No.	Phone No.
	A		
227-228	ACI	236	800-983-1177
177	ACTION	222	+886-3-4520697**
542-543	ADONTEC GMBH	48IS 24	+49-7043-40440**
221	ADVANCED ENGINEERING CONCEPTS	236	310-379-1189
*	ADVANCED MICRO DEVICES (N.A.)	80NA 4-5	800-222-9323
119-120	AGE LOGIC	176	619-755-1000
61-62	ALADDIN KNOWLEDGE SYSTEMS (INT'L)	112	212-564-5678
61-62	ALADDIN KNOWLEDGE SYSTEMS (U.S.)	112	800-223-4277
122	ALLMICRO	116	800-653-4933
553	ALTEX ELECTRONICS	224NE 1	800-531-5369
555	ALTEX ELECTRONICS	224SO 1	800-531-5369
183	AMERICAN ADVANTECH	232	800-800-6889
63	AMERICAN POWER CONVERSION	32-33	800-800-4APC dpt A2
*	AMERICAN POWER CONVERSION	32A-B	401-788-2727**
178-179	ANGLE TECHNOLOGY INC	217	800-858-2173
*	ANTHRO CORP	108	800-325-3841
200-201	APPRO INTERNATIONAL INC	231	800-927-5464
136	ARTECON	172	800-872-2783
180	ASHTEK INC	209	800-801-9400
129	AT&T GLOBAL INFORMATION SOLUTIONS (N.A.)	56-57	800-447-1124 ext 1151
525-526	AXIS COMMUNICATIONS (INT'L)	104	+46 46 140500
	B		
132	BBN SOFTWARE PRODUCTS (N.A.)	82	800-331-2266 ext 130
64-65	BELL & HOWELL INC (INT'L)	76	708-675-7600
64-65	BELL & HOWELL INC (N.A.)	76	800-SCAN-494
245	BIT3 COMPUTERS	230	612-881-6955
450	BIX	249	800-695-4775
218-219	BOXLIGHT CORP	235	800-762-5757
*	BUSINESS SOFTWARE ALLIANCE	186	
*	BUSINESS WEEK (INT'L)	56	
*	BYTE BACK ISSUES (INT'L)	48IS 18	
*	BYTE EDITORIAL SURVEY	134	
*	BYTE EURODECK (INT'L)	82	603-924-2533
*	BYTE MOBILE OFFICE SWEEPSTAKES (U.S.)	183	
*	BYTE NETWORKING ON DISK	166	
66	BYTE ON CD ROM	126	
*	BYTE READER	199	
*	BYTE REPRINTS	136	603-924-2525
*	BYTE SUB MESSAGE	170	
*	BYTE SUB MESSAGE	184	
*	BYTE SUB MESSAGE	48IS 26	
*	BYTE SUBSCRIBER SERVICE	48IS 28	
*	BYTE WAREHOUSE	171	
	C		
127	CALIFORNIA PC PRODUCTS INC	182	800-394-4122
229-230	CAMELEON TECHNOLOGY INC	234	800-440-7466
118	CARDIFF SOFTWARE	168	619-931-4500
547-548	CASPER	48IS 26	+45-57-67-3000
*	CATHAY-WAVE	238	800-928-3001
*	CHEMPUTER (INT'L)	28-29	+49-69-71407-0
540-541	COMBYTE INC	CIV	303-229-0660
*	COMPAQ SERVERS (N.A.)	110-111	800-664-9888
503-504	COMPEX INC (INT'L)	93	714-630-7302
501-502	COMPEX INC (INT'L)	135	714-630-7302
67	COMPUSERVE	89	800-487-4838
*	COMPUSERVE	88A-B	800-487-4838
148	COMPUTER DISCOUNT WAREHOUSE	202-203	800-959-4CDW
236-237	COMPUTER GATE	230	408-730-0673
*	COMPUTER PROF'S BOOK SOCIETY (N.A.)	185	614-759-3666
*	COMPUTER PROF'S BOOK SOCIETY (N.A.)	184A-B	614-759-3749**
*	COMPUTER PURCHASER'S HELP LINE	238	900-976-8723
505	COMPUTER QUICK	48IS 12	415-861-8330
149	COMPUTERLANE UNLIMITED	228	800-526-3482
68	COREL CD OFFICE COMPANION	41	613-728-0826 ext 3080
69	COREL DRAW 6	115	613-728-0826 ext 3080
233-234	CORPORATE UPGRADES	234	800-240-6190
113	CREATIVE LABS INC	23	800-998-5227
150-151	CYBEX CORP	205	205-430-4030**
152-153	CYBEX CORP	219	205-430-4030**
506-507	CYBEX CORP (INT'L)	CIII	205-430-4030**
	D		
*	DATA ACCESS CORP	208	800-451-3539
*	DATA COMMUNICATIONS	224NE 2-3	
*	DATA COMMUNICATIONS	224PC 2-3	
*	DATA COMMUNICATIONS	224SO 2-3	
*	DATA COMMUNICATIONS (INT'L)	38-39	
*	DATA COMMUNICATIONS (INT'L)	74-75	
154	DATALUX CORP	204	800-DATALUX
*	DATAPRO	158	
*	DELL COMPUTER CORP (N.A.)	CIII	800-766-4400
*	DELL COMPUTER CORP (N.A.)	CIV	800-759-1260
*	DELL COMPUTER CORP (N.A.)	28-29	800-766-3300
*	DELL COMPUTER CORP (N.A.)	99	800-822-3383
*	DELL COMPUTER CORP (N.A.)	158-159	800-825-6459
*	DELL COMPUTER CORP (N.A.,FORTUNE 1000)	CIII	800-866-6095
*	DELL COMPUTER CORP (N.A.,FORTUNE 1000)	CIV	800-825-9911
171	DESIGNER CHECKS	227	800-239-4087
533-534	DISTINCT CORP	48IS 16	408-366-8933
155	DISTRIBUTED PROCESSING TECHNOLOGY	212	407-830-5522
	E		
181-182	ELSNER TECHNOLOGIES (U.S.)	225	800-243-2228
215	EMATEK GMBH	237	+49 221 529666
551-552	E-TECH (INT'L)	183	+886-35-777751**
510	EUTRON	48IS 20	+39 35 201003
	F		
531	F & H SIMULATIONS (INT'L)	21	+31 13 427 516**
511-512	FAST (HARDLOCK)	48IS 7	+49-89-539800-20
529	FINSON (INT'L)	151	+39-2-6698-7036
523	FIRST INTERNATIONAL COMP	48IS 2	+886-2-718-2782**
156-157	FIRST SOURCE INT'L	220	714-448-7750
539	FISKARS POWERS SYSTEMS	48IS 9	+358 0 452661
72	FRAME TECHNOLOGY (N.A.)	21	800-U4FRAME ext 640
70-71	FRONTIER TECHNOLOGIES	184	800-929-3054
*	FUTURE MICRO INC	214	714-622-9137
216	FUZIWARE INC	238	800-472-6183
	G		
184	GAGE APPLIED SCIENCES INC	232	514-337-6893
*	GATEWAY 2000	42-45	800-846-2058
*	GATEWAY 2000	162-163	800-846-4289
238-239	GLOBETEK	230	800-229-4640
204-205	GRANITE DIGITAL	233	510-471-6442
513	GREY MATTER LTD	48IS 10	+44-(0)1364-53071
535-536	GVC CORP (INT'L)	143	+886-2-704-0338**
	H		
*	HEWLETT-PACKARD	37	800-964-1066
185	HIGH RES TECHNOLOGIES INC	233	416-497-6493 ext 106
186	HOOLEON CORP	234	520-634-7515
	I		
*	IBM APPLICATIONS DEVELOPMENT	59	800-3-IBM-OS2 ext SA034
*	IBM DATA MANAGEMENT (N.A.)	38-39	800-IBM-3333 ext GA061
*	IBM OS/2 (N.A.)	24-25	800-IBM-3333 ext EA100
*	IBM PERSONAL POWER PC (N.A.)	10-11	800-IBM-4FAX #8133643
133	IBM SERVERS (N.A.)	74-75	800-IBM-3333 ext FA179
222-223	ICL (EMBLA)	236	703-648-3326**
*	IDT	237	800-743-4343
210	IERC	230	818-842-7277
549-550	INFOCUS (INT'L)	99	+31-2503-23200
187	INTEGRAND RESEARCH	232	209-651-1203
73	INTEGRIX INC	175	800-300-8288
*	INTEL CORP	18-19	800-538-3373
74-75	INTERGRAPH CORP	90	800-291-9909
518-519	INTERGRAPH CORP	48IS 15	205-730-5499
188	IO TECH	233	216-439-4091
	J		
*	JDR MICRODEVICES	229	800-538-5000
	K		
189	KILA	232	303-444-7737
76-77	KINGSTON TECHNOLOGY	95	714-435-2600
78-79	KINGSTON TECHNOLOGY	157	714-438-1850
170	KLEINMANN GMBH	223	+49-7128-9292-92**
	L		
166-167	L A TRADE	226	800-433-3726
190	LAHEY COMPUTER SYSTEMS	237	800-548-4778
121	LANSOURCE TECHNOLOGY	141	416-535-3555
181-182	LIGHTSTONE SYSTEMS GMBH (INT'L)	225	+49-5643-9801-22**
560-561	LOGIC PROGRAMMING ASSOCIATES	48IS 22	800-949-7567
	M		
169	MACON	223	+49-7254-983-290**
527	MANNESMANN TALLY	48IS 23	+44 (0) 1734 788711
139-140	MAXTECH CORP (N.A.)	143	201-579-3630
*	MCGRAW-HILL COMPANIES (INT'L)	110	
545-546	MDI SYSTEMS LTD	48IS 27	+44(0)1368 850678
128	MEGAHERTZ CORP (N.A.)	151	800-LINKING ext 4324
544	MESSE MUENCHEN GMBH (SYSTEMS 95)	48IS 13	+49-89-5107-506
*	MICRO 2000	210	800-864-8008
250-251	MICRO 2000	211	800-864-8008
246	MICRO ALLIANCE	235	619-598-1900
537-538	MICRO DIRECT INT'L	48IS 14	415-325-3178
158-159	MICRO SOLUTIONS COMP PROD	213	800-295-1214
80-81	MICROGRAFX	73	800-877-3040
*	MICROGRAFX	193	800-357-7255
164	MICRO-INTERNATIONAL INC	218	800-967-5667
114	MICRON COMPUTER	CII-1	208-465-3434
*	MICROSOFT CORP	2-5	
*	MICROSTAR LABORATORIES	233	206-453-2345
*	MICROWAY	144	508-746-7341
528	MITAC INTERNATIONAL CORP (INT'L)	159	+886-2-501-4265**
82	MOTOROLA	121	800-894-7353
*	MOTOROLA	100-101	
*	MOTOROLA	102-103	
144-145	MRT (INT'L)	125	+47-638-92020
144-145	MRT (U.S.)	125	603-465-2830
	N		
191	NATIONAL INSTRUMENTS	233	512-794-0100
*	NEC	14-15	
83	NSTL	169	800-220-NSTL
	O		
217	OBJECT MANAGEMENT LAB	238	800-6789-OML
514-515	OLIVETTI S.P.A. (INT'L)	10-11	+39-2-48361
516-517	OLIVETTI S.P.A. (INT'L)	24-25	+39-125-52
524	ON TIME MARKETING	48IS 22	+49-40-437472
252-253	ORCHESTRA MULTISYSTEMS	224	800-237-9988
*	OSBORNE MCGRAW-HILL	194-195	800-822-8158
	P		
84	PANASONIC COMMUNICATIONS & SYSTEMS	149	800-742-8086 ext PD
243	PANELIGHT	235	800-726-3599
85	PASSPORT DESIGNS INC (N.A.)	135	415-726-0280
*	PC EXPO IN CHICAGO	189	801-655-8024
176	PC'S COMPLEAT	206-207	508-624-6400
86	PERSOFT INC	131	800-TCP-3130
192	PERSONAL TEX	236	800-808-7906
206-207	PIKA TECHNOLOGIES	230	613-591-1555
87-88	PINNACLE MICRO	9	714-727-3300
89	PKWARE INC	132	414-354-8699
90	PKWARE INC	187	414-354-8699
174-175	POLYCON GMBH DATA SYSTEMS	227	+49-521-9861322**
115-116	PROXIMA CORP	68	800-447-7694
	Q		
91	QNX SOFTWARE SYSTEMS LTD	17	800-676-0566 ext 1008

ADVERTISER CONTACT INFORMATION

Inquiry No.		Page No.	Phone No.
193	QUALSTAR CORP	236	800-468-0680
92-93	QUARTERDECK OFFICE SYS	139	310-392-9851
94-95	QUATECH INC	200	800-553-1170
	R		
521-522	RAIMA CORP	48IS 8	206-557-0200
96	RAINBOW TECHNOLOGIES	47	800-852-8569
141	RAVE COMPUTER ASSOCIATES	128	800-966-RAVE
211-212	RCI	231	800-RCI-8090 ext 71
565-566	RECOGNITA (INT'L)	57	+36-1-2018925
194	RHETOREX INC	231	408-370-0881
160-161	ROSE ELECTRONICS	222	800-333-9343
	S		
97-98	SAMTRON DISPLAYS INC (N.A.)	80NA 7	310-537-7000
125-126	SCEPTRE TECHNOLOGIES	155	800-788-2878
242	SCI TRAN PRODUCTS	233	412-367-7063
165	SCITECH INTERNATIONAL	221	800-622-3345
240-241	SERMAX	234	800-209-7126
146	SERVINT CORP (N.A.)	104	800-5SERVINT
208-209	SHAFFSTALL CORP	236	800-248-3475
*	SIEMENS NIXDORF INFORMATION (INT'L)	48IS A-H	+49-89-636-48749**
*	SIEMENS NIXDORF INFORMATION (INT'L)	48IS I-J	+49-89-636-48749**
202-203	SIGMA TECH SOFTWARE	231	818-368-6132
*	SILICON GRAPHICS	35	800-636-8184 D440
220	SILICONRAX	232	800-700-8560
195	SILICONSOFT INC	238	800-969-4411
520	SMILE	48IS 4	+886-2-754-2829**
562-563	SOFT & NET DSTIBUTION SA	48IS19	+44-151-794-3684
134-135	SOFTWAY AMERICA INC	168	303-670-5345
172-173	SOLID COMPUTER GMBH	215	+49-89-3159146**
567	SOLID COMPUTER GMBH (INT'L)	111	+49-89-3159146**
101	SPSS INC	145	800-543-5835
231-232	STARTECH COMPUTER PRODUCTS	231	800-265-1844 ext 231
254	STATSOFT	85	918-583-4149
117	SUPRA CORP (N.A.)	80NA 1	800-727-8647
110	SYMANTEC	61	800-628-4777 9AP9
111	SYMANTEC	63	800-628-4777 9AP11
112	SYMANTEC	65	800-628-4777 9AP12
	T		
225-226	TALKIE	236	800-TALKIE-4
196	TALKING TECHNOLOGY INC	231	800-685-4884
213-214	TAPEDISK CORP	235	800-827-3372
102	TEKTRONIX	87	800-835-6100 ext 1223
554	TELEDAPTER SYSTEMS INC	224NE 4	800-997-7762
559	TELEDAPTER SYSTEMS INC	224PC 4	800-997-7762
556	TELEDAPTER SYSTEMS INC	224SO 4	800-997-7762
103-104	TEXAS INSTRUMENTS	66-67	800-TI-TEXAS
557-558	TNPC	224PC 1	+886-2-999-3435**
105	TOSHIBA AMERICA INC	50-51	800-457-7777
199	TRI VALLEY TECHNOLOGY INC	232	510-447-2030
137-138	TRITEAL CORP	119	800-874-8325
	U		
142-143	UNIDIRECT	124	800-755-UNIX
224	UNITED EDUCATION CENTERS	237	800-877-4889 ext 28
	V		
197	VIDEX INC	230	503-758-0521
106-107	VIEWSONIC	79	909-869-7976
147	VISIO CORP (N.A.)	93	800-24-VISIO ext E23
	W		
*	WALKER, RICHER & QUINN	13	206-217-7100
108	WATCOM C/C++ 10.5	31	519-886-3700
244	WETEX INTERNATIONAL	234	800-75WETEX
168	WIBU (INT'L)	223	+49-721-93172-22**
168	WIBU (U.S.)	223	301-570-3497
162	WORLDWIDE TECHNOLOGIES	216	215-922-0116**
	Z		
109	ZEOS INTERNATIONAL	152-153	800-554-5226
198	Z-WORLD ENGINEERING	234	916-757-3737
123-124	ZYXEL USA	109	714-693-0808

** Correspond directly with company.*
*** Indicates FAX Number*

Regional Edition Definitions:

DM – Ads only appear in Demographic Edition
EUROPE – Ads only appear in Europe Edition
IS/INT'L – Ads only appear in International Edition
MW – Ads only appear in Midwest Region Edition
N.A. – Ads only appear in North America Edition
NE – Ads only appear in Northeast Region Edition
PC – Ads only appear in Pacific Coast Region Edition
SO – Ads only appear in Southern Region Edition
U.S. – Ads only appear in U.S. Edition
WORLD – Ads only appear in World Edition

BYTE ADVERTISING SALES STAFF

John M. Griffin, V.P. of Sales, One Phoenix Mill Lane, Peterborough, NH 03458, Tel: (603) 924-2663, Fax: (603) 924-2683
Diane Lieberman, Advertising Director, One Phoenix Mill Lane, Peterborough, NH 03458, Tel: (603) 924-2518, Fax: (603) 924-2683

NEW ENGLAND
ME, NH, Upstate NY, VT, MA, RI, CT, ONTARIO, CANADA, EASTERN CANADA
Sanford L. Fibish **(617) 860-6344**
Merle Model **(617) 860-6221**
The McGraw-Hill Companies
24 Hartwell Avenue
Lexington, MA 02173
FAX: (617) 860-6899

CENTRAL U.S.
IL, MO, KS, IA, ND, SD, MN, WI, NE, IN, MI, OH, GA, SC, TN, KY
Lori Silverstein **(614) 899-4908**
Kevin Lary **(614) 899-4912**
Ed Ware **(603) 924-2664**
The McGraw-Hill Companies
921 Eastwind Drive, Suite 118
Westerville, OH 43081
FAX: (614) 899-4999

NORTH PACIFIC
NORTHERN CA, OR, ID, MT, WY, UT, SILICON VALLEY, HI, WA, AK, W. CANADA
Roy J. Kops **(415) 513-6861**
Susan Rastellini **(415) 513-6951**
The McGraw-Hill Companies
1900 O'Farrell Street, Suite 200
San Mateo, CA 94403
FAX: (415) 513-6867

MID-ATLANTIC
NY, NYC, NJ, DE, DC, MD, PA, VA, NC, WV
Michael Feinberg **(212) 512-4811**
Margot L. Swanson **(603) 924-2651**
The McGraw-Hill Companies
1221 Avenue of Americas—28th Floor
New York, NY 10020
FAX: (212) 512-2075

SOUTHWEST, SOUTHEAST
ROCKY MOUNTAIN, CO, OK, TX, AL, FL, MS, AR, LA
Jennifer Walker **(214) 701-8496**
Kevin Lary **(614) 899-4909**
The McGraw-Hill Companies
14850 Quorum Dr., Suite 380
Dallas, TX 75240
FAX: (214) 991-6208

SOUTH PACIFIC
SOUTHERN CALIFORNIA, AZ, NM, NV
Beth Dudas **(714) 753-8140**
Mark Speros **(714) 753-8140**
The McGraw-Hill Companies
15635 Alton Pkwy., Suite 290
Irvine, CA 92718
FAX: (714) 753-8147

Peterborough, NH Office:
Inside Sales FAX: **603-924-2683**
Advertising FAX: **603-924-7507**

BYTE Deck
Brian Higgins **(603) 924-2596**
BYTE
One Phoenix Mill Lane
Peterborough, NH 03458

EURO-DECK
Joseph Mabe **(603) 924-2533**
BYTE
One Phoenix Mill Lane
Peterborough, NH 03458

Regional Advertising Sections
Brian Higgins **(603) 924-2596**
BYTE
One Phoenix Mill Lane
Peterborough, NH 03458

NEW MEDIA/ONLINE PRODUCTS
Brad Dixon **(603) 924-2574**
BYTE
One Phoenix Mill Lane
Peterborough, NH 03458
FAX: **(603) 924-2683**

INTERNATIONAL ADVERTISING SALES STAFF

L. Bradley Browne, International Sales Director, One Phoenix Mill Lane, Peterborough, NH 03458, Tel: (603) 924-2501, Fax: (603) 924-2683

UNITED KINGDOM, BENELUX
Gary Lucas **(+44 171 495 6780)**
Jonathan McGowan **(+44 171 495 6781)**
The McGraw-Hill Companies
34 Dover St.
London W1X 4BR
England
FAX: +44 171 4956734

GERMANY, SWITZERLAND, AUSTRIA
Jürgen Heise
The McGraw-Hill Companies
Liebigstrasse 19
D-60323 Frankfurt
Germany
Tel: +49 69 7140 7140
FAX: +49 69 7140 7146

ITALY, FRANCE, SPAIN, PORTUGAL, SCANDINAVIA
Zena Coupé, Amanda Blaskett
A-Z International Sales Ltd.
70 Chalk Farm Road
London NW1 8AN
England
Tel: +44 171 2843171
FAX: +44 171 2843174

ISRAEL
Dan Aronovic
DARA International
41 Ravutski
Ra'anana 43220
Israel
Tel: +972 9 919544
FAX: +972 9 981934

TAIWAN
Janet Wang
Third Wave Publishing Corp.
2nd Fl., No. 19-2, Lane 231
Fu Hsing North Road
Taipei 105, Taiwan
R.O.C.
Tel: +886 2 7136959
FAX: +886 2 7189467

HONG KONG
Zoe Yen
Third Wave Publishing Corp.
Unit 2, 6F Hing Wah Center
82-84 To Kwa Wan Road
Kowloon, Hong Kong
Tel: +852 764 3830
FAX: +852 764 3857

KOREA
Young-Seoh Chinn
JES Media International
6th Fl., Donghye Bldg.
47-16, Myungil-Dong
Kangdong-Gu
Seoul 134-070, Korea
Tel: +82 2 4813411
FAX: +82 2 4813414

JAPAN
Hirokazu Morita
Japanese Advertising Communications, Inc.
Three Star Building
3-10-3 Kanda Jimbocho
Chiyoda-ku, Tokyo 101
Japan
Tel: +81 3 32614591
FAX: +81 3 32616126

AUSTRALIA
Phil Bush
National Advertising Services
7-13 Parraween Street
Cremorne NSW 2090,
Australia
Tel: +61 2 908 9329
FAX: +61 2 953 8274

SINGAPORE, INDIA, INDONESIA, PAKISTAN, PHILIPPINES, OTHER ASIAN AND PACIFIC COUNTRIES
Janet Wang
Third Wave Publishing Corp.
2nd Fl., No. 19-1, Lane 231
Fu Hsing North Road
Taipei 105, Taiwan
R.O.C.
Tel: +886 2 7136959 ext. 226
FAX: +886 2 7189467

MALAYSIA
H.K. Lim
Servex (Malaysia) Sdn. Bhd.
5th Floor, Bena Tower
160, Jalan Ampang
50450 Kuala Lumpur
Malaysia
Tel: +60 3 2624592
FAX: +60 3 2624591

Subscription Customer Service
U.S. 1-800-232-2983
Outside U.S. +1-609-426-7676

For a New Subscription
U.S. 1-800-257-9402
Outside U.S. +1-609-426-5526

INDEX TO ADVERTISED PRODUCTS

For FREE product information from individual advertisers, circle the corresponding inquiry numbers on the response card!

To receive information for an entire product category, circle the category number on the response card!

HARDWARE

1 ACCESSORIES

Inquiry No.		Page No.
*	ANTHRO CORP	108
236-237	COMPUTER GATE	230
210	IERC	230

2 ADD-IN BOARDS

Inquiry No.		Page No.
245	BIT3 COMPUTERS	230
229-230	CAMELEON TECHNOLOGY INC	234
*	FUTURE MICRO INC	214
238-239	GLOBETEK	230
206-207	PIKA TECHNOLOGIES	230
94-95	QUATECH INC	200
196	TALKING TECHNOLOGY INC	231
557-558	TNPC	224PC 1

3 BAR CODING

Inquiry No.		Page No.
197	VIDEX INC	230

4 COMMUNICATIONS/NETWORKING

Inquiry No.		Page No.
553	ALTEX ELECTRONICS	224NE 1
555	ALTEX ELECTRONICS	224SO 1
525-526	AXIS COMMUNICATIONS (INT'L)	104
245	BIT3 COMPUTERS	230
76-77	KINGSTON TECHNOLOGY	95
139-140	MAXTECH CORP (N.A.)	143
128	MEGAHERTZ CORPORATION (N.A.)	151
206-207	PIKA TECHNOLOGIES	230
174-175	POLYCON GMBH DATA SYSTEMS	227
211-212	RCI	231
194	RHETOREX INC	231
160-161	ROSE ELECTRONICS	222
146	SERVINT CORP (N.A.)	104
202-203	SIGMA TECH SOFTWARE	231
172-173	SOLID COMPUTER GMBH	215
567	SOLID COMPUTER GMBH (INT'L)	111
231-232	STARTECH COMPUTER PRODUCTS	231
196	TALKING TECHNOLOGY INC	231

5 COMPUTER SYSTEMS

Inquiry No.		Page No.
178-179	ANGLE TECHNOLOGY INC	217
200-201	APPRO INTERNATIONAL INC	231
129	AT&T GLOBAL INFO SOLUTIONS (N.A.)	56-57
245	BIT3 COMPUTERS	230
*	COMPAQ SERVERS (N.A.)	110-111
154	DATALUX CORPORATION	204
*	DELL COMPUTER CORP (N.A.)	CIII
*	DELL COMPUTER CORP (N.A.)	CIV
*	DELL COMPUTER CORP (N.A.)	28-29
*	GATEWAY 2000	42-45
*	GATEWAY 2000	162-163
*	IBM PERSONAL POWER PC (N.A.)	10-11
133	IBM SERVERS (N.A.)	74-75
187	INTEGRAND RESEARCH	232
73	INTEGRIX INC	175
*	INTEL CORPORATION	18-19
189	KILA	232
181-182	LIGHTSTONE SYSTEMS GMBH	225
114	MICRON COMPUTER	CII-1
83	NSTL	169
514-515	OLIVETTI S.P.A. (INT'L)	10-11
176	PC'S COMPLEAT	206-207
141	RAVE COMPUTER ASSOCIATES	128
*	SIEMENS NIXDORF INFO (INT'L)	48A-H
*	SILICON GRAPHICS	35
220	SILICONRAX	232
557-558	TNPC	224PC 1
199	TRI VALLEY TECHNOLOGY INC	232
109	ZEOS INTERNATIONAL	152-153

6 DATA ACQUISITION

Inquiry No.		Page No.
183	AMERICAN ADVANTECH	232
184	GAGE APPLIED SCIENCES INC	232
185	HIGH RES TECHNOLOGIES INC	233
188	IO TECH	233
*	MICROSTAR LABORATORIES	233
191	NATIONAL INSTRUMENTS	233
94-95	QUATECH INC	200
242	SCI TRAN PRODUCTS	233

53 DIAGNOSTIC EQUIPMENT

Inquiry No.		Page No.
*	MICRO 2000	210
250-251	MICRO 2000	211

7 DISK & OPTICAL DRIVES

Inquiry No.		Page No.
136	ARTECON	172
180	ASHTEK INC	209
*	COMPUTER PURCHASER'S HELP LINE	238
204-205	GRANITE DIGITAL	233
76-77	KINGSTON TECHNOLOGY	95
78-79	KINGSTON TECHNOLOGY	157
158-159	MICRO SOLUTIONS COMP PROD	213
84	PANASONIC COMMS & SYSTEMS	149
87-88	PINNACLE MICRO	9

9 FAX BOARDS/MACHINES

Inquiry No.		Page No.
206-207	PIKA TECHNOLOGIES	230
117	SUPRA CORPORATION (N.A.)	80NA 1

11 KEYBOARDS

Inquiry No.		Page No.
154	DATALUX CORPORATION	204
186	HOOLEON CORPORATION	234

12 LAN HARDWARE

Inquiry No.		Page No.
503-504	COMPEX INC (INT'L)	93
501-502	COMPEX INC (INT'L)	135
150-151	CYBEX CORPORATION	205
152-153	CYBEX CORPORATION	219
506-507	CYBEX CORPORATION (INT'L)	CIII
156-157	FIRST SOURCE INT'L	220
181-182	LIGHTSTONE SYSTEMS GMBH	225
139-140	MAXTECH CORP (N.A.)	143

13 LAPTOPS & NOTEBOOKS

Inquiry No.		Page No.
233-234	CORPORATE UPGRADES	234
*	DELL COMPUTER CORP (N.A.)	99
*	DELL COMPUTER CORP (N.A.)	158-159
523	FIRST INTERNATIONAL COMPUTER	48IS 2
*	JDR MICRODEVICES	229
164	MICRO-INTERNATIONAL INC	218
528	MITAC INTERNATIONAL CORP (INT'L)	159
82	MOTOROLA	121
*	NEC	14-15
176	PC'S COMPLEAT	206-207
125-126	SCEPTRE TECHNOLOGIES	155
103-104	TEXAS INSTRUMENTS	66-67
105	TOSHIBA AMERICA INC	50-51
109	ZEOS INTERNATIONAL	152-153

14 MAIL ORDER

Inquiry No.		Page No.
553	ALTEX ELECTRONICS	224NE 1
555	ALTEX ELECTRONICS	224SO 1
148	COMPUTER DISCOUNT WAREHOUSE	202-203
149	COMPUTERLANE UNLIMITED	228
537-538	MICRO DIRECT INTERNATIONAL	48IS 14
176	PC'S COMPLEAT	206-207
244	WETEX INTERNATIONAL	234

15 MEMORY/CHIPS/UPGRADES

Inquiry No.		Page No.
*	ADVANCED MICRO DEVICES (N.A.)	80NA 4-5
229-230	CAMELEON TECHNOLOGY INC	234
*	COMPUTER PURCHASER'S HELP LINE	238
156-157	FIRST SOURCE INT'L	220
*	FUTURE MICRO INC	214
*	INTEL CORPORATION	18-19
76-77	KINGSTON TECHNOLOGY	95
166-167	L A TRADE	226
240-241	SERMAX	234
162	WORLDWIDE TECHNOLOGIES	216

16 MISCELLANEOUS HARDWARE

Inquiry No.		Page No.
127	CALIFORNIA PC PRODUCTS INC	182
246	MICRO ALLIANCE	235
*	MOTOROLA	100-101
*	MOTOROLA	102-103
*	NEC	14-15

17 MODEMS/MULTIPLEXORS

Inquiry No.		Page No.
551-552	E-TECH (INT'L)	183
*	JDR MICRODEVICES	229
139-140	MAXTECH CORP (N.A.)	143
128	MEGAHERTZ CORPORATION (N.A.)	151
117	SUPRA CORPORATION (N.A.)	80NA 1
554	TELEDAPTER SYSTEMS INC	224NE 4
559	TELEDAPTER SYSTEMS INC	224PC 4
556	TELEDAPTER SYSTEMS INC	224SO 4
123-124	ZYXEL USA	109

18 MONITORS & TERMINALS

Inquiry No.		Page No.
177	ACTION	222
154	DATALUX CORPORATION	204
535-536	GVC CORP (INT'L)	143
252-253	ORCHESTRA MULTISYSTEMS	224
97-98	SAMTRON DISPLAYS INC (N.A.)	80NA 7
520	SMILE	48IS 4
106-107	VIEWSONIC	79

19 MULTIMEDIA/CD-ROM

Inquiry No.		Page No.
218-219	BOXLIGHT CORPORATION	235
113	CREATIVE LABS INC	23
*	FUTURE MICRO INC	214
549-550	INFOCUS (INT'L)	99
144-145	MRT	125
243	PANELIGHT	235
85	PASSPORT DESIGNS INC (N.A.)	135
115-116	PROXIMA CORPORATION	68
*	SILICON GRAPHICS	35
213-214	TAPEDISK CORPORATION	235

20 PRINTERS/PLOTTERS

Inquiry No.		Page No.
*	HEWLETT-PACKARD	37
527	MANNESMANN TALLY	48IS 23
516-517	OLIVETTI S.P.A. (INT'L)	24-25
102	TEKTRONIX	87

INDEX TO ADVERTISED PRODUCTS

Inquiry No.		Page No.
21	**PROGRAMMABLE HARDWARE**	
*	DATA ACCESS CORP	208
511-512	FAST (HARDLOCK)	48IS 7
*	JDR MICRODEVICES	229
170	KLEINMANN GMBH	223
169	MACON	223
96	RAINBOW TECHNOLOGIES	47
168	WIBU	223
198	Z-WORLD ENGINEERING	234
56	**RAID DRIVE ARRAYS**	
155	DISTRIBUTED PROCESSING TECH	212
22	**SCANNERS/OCR/DIGITIZERS**	
64-65	BELL & HOWELL INC	76
545-546	MDI SYSTEMS LTD	48IS 27
565-566	RECOGNITA (INT'L)	57
52	**SECURITY**	
221	ADVANCED ENGINEERING CONCEPTS	236
61-62	ALADDIN KNOWLEDGE SYSTEMS	112
511-512	FAST (HARDLOCK)	48IS 7
170	KLEINMANN GMBH	223
169	MACON	223
96	RAINBOW TECHNOLOGIES	47
168	WIBU	223
23	**TAPE DRIVES**	
540-541	COMBYTE INC (INT'L)	CIV
158-159	MICRO SOLUTIONS COMP PROD	213
193	QUALSTAR CORP	236
208-209	SHAFFSTALL CORP	236
213-214	TAPEDISK CORPORATION	235
24	**UPS/POWER MANAGEMENT**	
227-228	ACI	236
*	AMERICAN POWER CONVERSION	32A-B
63	AMERICAN POWER CONVERSION	32-33
539	FISKARS POWERS SYSTEMS	48IS 9

SOFTWARE

Inquiry No.		Page No.
25	**BUSINESS**	
132	BBN SOFTWARE PRODUCTS (N.A.)	82
118	CARDIFF SOFTWARE	168
*	COMPUTER PURCHASER'S HELP LINE	238
171	DESIGNER CHECKS	227
529	FINSON (INT'L)	151
*	IBM APPLICATIONS DEVELOPMENT	59
80-81	MICROGRAFX	73
115-116	PROXIMA CORPORATION	68
27	**COMMUNICATIONS/ NETWORKING**	
119-120	AGE LOGIC	176
547-548	CASPER	48IS 26
503-504	COMPEX INC (INT'L)	93
501-502	COMPEX INC (INT'L)	135
533-534	DISTINCT CORPORATION	48IS 16
156-157	FIRST SOURCE INT'L	220
70-71	FRONTIER TECHNOLOGIES	184
222-223	ICL (EMBLA)	236
121	LANSOURCE TECHNOLOGY	141
*	MICROSOFT CORPORATION	2-5
86	PERSOFT INC	131
195	SILICONSOFT INC	238
562-563	SOFT & NET DSTIBUTION SA	48IS19
225-226	TALKIE	236
*	WALKER, RICHER & QUINN	13
29	**DATABASE**	
*	IBM DATA MANAGEMENT (N.A.)	38-39
30	**EDUCATIONAL**	
224	UNITED EDUCATION CENTERS	237
31	**ENGINEERING/SCIENTIFIC**	
531	F & H SIMULATIONS (INT'L)	21
560-561	LOGIC PROGRAMMING ASSOCIATES	48IS 22
192	PERSONAL TEX	236
33	**GRAPHICS**	
68	COREL CD OFFICE COMPANION	41
69	COREL DRAW 6	115
215	EMATEK GMBH	237
80-81	MICROGRAFX	73
*	MICROGRAFX	193
85	PASSPORT DESIGNS INC (N.A.)	135
115-116	PROXIMA CORPORATION	68
35	**MAIL ORDER**	
148	COMPUTER DISCOUNT WAREHOUSE	202-203
505	COMPUTER QUICK	48IS 12
513	GREY MATTER LTD	48IS 10
36	**MATHEMATICAL/STATISTICAL**	
192	PERSONAL TEX	236
101	SPSS INC	145
254	STATSOFT	85
37	**MISCELLANEOUS SOFTWARE**	
529	FINSON (INT'L)	151
524	ON TIME MARKETING	48IS 22
38	**ON-LINE SERVICES**	
450	BIX	249
*	COMPUSERVE	88A-B
67	COMPUSERVE	89
*	IDT	237
195	SILICONSOFT INC	238
39	**OPERATING SYSTEMS**	
181-182	LIGHTSTONE SYSTEMS GMBH	225
91	QNX SOFTWARE SYSTEMS LTD	17
92-93	QUARTERDECK OFFICE SYSTEMS	139
137-138	TRITEAL CORPORATION	119
54	**OS/2**	
*	IBM OS/2 (N.A.)	24-25
40	**PROGRAMMING LANGUAGES/ TOOLS**	
542-543	ADONTEC GMBH	48IS 24
547-548	CASPER	48IS 26
215	EMATEK GMBH	237
513	GREY MATTER LTD	48IS 10
190	LAHEY COMPUTER SYSTEMS	237
560-561	LOGIC PROGRAMMING ASSOCIATES	48IS 22
*	MICROWAY	144
217	OBJECT MANAGEMENT LABORATORY	238
524	ON TIME MARKETING	48IS 22
521-522	RAIMA CORP	48IS 8
*	WALKER, RICHER & QUINN	13
108	WATCOM C/C++ 10.5	31
41	**SECURITY**	
61-62	ALADDIN KNOWLEDGE SYSTEMS	112
510	EUTRON	48IS 20
511-512	FAST (HARDLOCK)	48IS 7
170	KLEINMANN GMBH	223
169	MACON	223
96	RAINBOW TECHNOLOGIES	41
168	WIBU	223
45	**UNIX**	
119-120	AGE LOGIC	176
533-534	DISTINCT CORPORATION	48IS 16
72	FRAME TECHNOLOGY (N.A.)	21
74-75	INTERGRAPH CORPORATION	90
518-519	INTERGRAPH CORPORATION	48IS 15
521-522	RAIMA CORP	48IS 8
562-563	SOFT & NET DSTIBUTION SA	48IS19
134-135	SOFTWAY AMERICA INC	168
137-138	TRITEAL CORPORATION	119
142-143	UNIDIRECT	124
*	WALKER, RICHER & QUINN	13
46	**UTILITIES**	
122	ALLMICRO	116
*	MICRO 2000	210
250-251	MICRO 2000	211
89	PKWARE INC	132
90	PKWARE INC	187
92-93	QUARTERDECK OFFICE SYSTEMS	139
110	SYMANTEC	61
111	SYMANTEC	63
112	SYMANTEC	65
213-214	TAPEDISK CORPORATION	235
47	**WINDOWS**	
132	BBN SOFTWARE PRODUCTS (N.A.)	82
533-534	DISTINCT CORPORATION	48IS 16
529	FINSON (INT'L)	151
70-71	FRONTIER TECHNOLOGIES	184
216	FUZIWARE INC	238
513	GREY MATTER LTD	48IS 10
*	MICROSOFT CORPORATION	2-5
562-563	SOFT & NET DSTIBUTION SA	48IS19
110	SYMANTEC	61
111	SYMANTEC	63
112	SYMANTEC	65
147	VISIO CORPORATION (N.A.)	93
48	**WORD PROCESSING**	
72	FRAME TECHNOLOGY (N.A.)	21

GENERAL

Inquiry No.		Page No.
49	**BOOKS/PUBLICATIONS**	
*	BUSINESS WEEK (INT'L)	56
66	BYTE ON CD ROM	126
*	BYTE READER	199
*	COMPUTER PROF'S BOOK SOCIETY (N.A.)	184A-B
*	COMPUTER PROF'S BOOK SOCIETY	185
*	DATA COMMUNICATIONS (INT'L)	38-39
*	DATA COMMUNICATIONS (INT'L)	74-75
*	DATAPRO	158
*	OSBORNE MCGRAW-HILL	194-195
51	**MISCELLANEOUS**	
*	BUSINESS SOFTWARE ALLIANCE	186
*	BYTE BACK ISSUES (INT'L)	48IS 18
*	BYTE EDITORIAL SURVEY	134
*	BYTE MOBILE OFFICE SWEEPSTAKES (U.S.)	183
*	BYTE NETWORKING ON DISK	166
*	BYTE REPRINTS	136
*	BYTE SUB MESSAGE	170
*	BYTE SUB MESSAGE	184
*	BYTE SUB MESSAGE	48IS 26
*	BYTE SUBSCRIBER SERVICES	48IS 28
*	BYTE WEARHOUSE	171
*	CATHAY-WAVE	238
*	CHEMPUTER (INT'L)	28-29
*	MCGRAW-HILL COMPANIES (INT'L)	110
544	MESSE MUENCHEN GMBH (SYSTEMS 95)	48IS 13
*	PC EXPO IN CHICAGO	189

EDITORIAL INDEX

For more information on any of the companies covered in articles, columns, or news stories in this issue, circle the appropriate inquiry number on the response card. Each page number refers to the first page of the article or section in which the company name appears.

Inquiry No.		Page No.
	A	
	Aberdeen Group	97
	AbTech	83
1014	ACI US	198
1165	A. C. Nielsen	83
	Acorn Computer	48IS 3
	Acotec	48IS 11
1070	Activision	117
1154	Alcom	137
1069	AlphaBox Software	117
	American Express	83
	Angoss Software	83
1246	AniCom	181
	ANS CO+RE Systems	179
	APC	26
976, 1063, 1065	Apple Computer	52, 69, 123, 129, 190, 48IS 5
	Arbor Software	83, 91
	AT&T	52
	AT&T Bell Labs	83
1229	AT&T Global Information Solutions	146
	AT&T Microelectronics	69
	ATI Technologies	26
	Atlantic Systems Group	179
998	Attachmate	196
1230, 1231	Austin Direct	146
	AVM	48IS 11
	B	
	Bay Networks	48IS 5, 48IS 11
	Bear Stearns	26
	Bell Laboratories	177
	BinTec	48IS 11
1029	Blue Earth Research	133
	Borland International	26, 137
	Brand Communications	48IS 11
	Brio Technology	91
	Business Objects	91
	C	
	Cardiff	137
1064	Casio	129
	Castelle	137
	CheckPoint Software Technologies	179
	Cheyenne	137
	Cirrus Logic	52
	Cisco Systems	48IS 11
	Cognos	91
	Coherent Research	77
1316	Colorgraphic Communications	48IS 21
1243	Columbia Data Products	181
1232	Compaq Computer	52, 146
	Comshare	91
1082	Connectix	52
1067	Corel	117
	Creative Labs	69
1320, 1340	Cristie Electronics	48IS 22, 48IS 23
	Crosswise	69
	Cross/Z International	91
	Crystal Services	91
1160	Customer Insight	83
	D	
	DataBeam	69
1343	Datapath	48IS 23
	Datapoint	69
1011	DataViz	197
1155	Delrina	137
1007	DeltaPoint	198
1325	Descartes Solutions	48IS 25
1084	DeskStation Technologies	52
988	Diamond Multimedia Systems	26, 123, 192
995, 1233	Digital Equipment	146, 179, 197, 48IS 5
	Dimensional Media Associates	26
1328	DP Advisors	48IS 26
	Dr. Materna	48IS 11
	E	
1061	Eastman Kodak	129
	F	
1317	Force Computers	48IS 21
981	Forte Technologies	191
1335	Frax	48IS 27
	Freemark Communications	26
1241	Fujitsu Computer Products of America	181
1345	Fujitsu Europe	48IS 23
	Future Domain	26
	FutureLabs	69
	G	
	GammaLink	137
986	Gandalf Technologies	190
	Gartner Group	97
1234	Gateway 2000	146
	G. Diehl ISDN	48IS 11
	General Motors	83
992	General Parametrics	191
1348	Gomark	48IS 27
	GTE Laboratories	83
	H	
	Harris Computer Systems	179
	Heusch/Boesefeldt	48IS 17
978, 1235	Hewlett-Packard	91, 146, 192, 48IS 5
1161, 1162	HNC Software	83
1068	Humongous Entertainment	117
	I	
	Ian Cating Consulting	48IS 17
1236	IBM	26, 52, 69, 83, 91, 97, 137, 146, 167, 179, 181, 48IS 5, 80NA 2
	ICL	48IS 3
1013	IMSI	197
1333	Incat Systems	48IS 25
	Information Advantages	91
	Information Builders	91
	Information Discovery	97
	InSoft	69
1312	Instrumentation Test & Measurement	48IS 23
1075	Intel	26, 52, 69, 48IS 5
	Intelligence at Large	69
1163	IntelligenceWare	83, 91
1005	Intergraph	196
1077	Intergraph Computer Systems	52
	International Data	52
	Internet Security	179
994	Intuit	196
	InVision Systems	69
	IQ Software	91
	ITK	48IS 11
	J	
1079	Jabra	52
1334	JBA	48IS 27
	Juno Internet Services	26
	L	
1008	Landmark Research International	198
1323	Lernout & Hauspie	48IS 25
	Linden Technology	77
	Lockheed	83
	Loewe Iscom	48IS 11
1062	Logitech	129
1314	Logix Communications	48IS 21
1030	Lotus Development	26, 127
	M	
1001	Macromedia	198
1315	MASE	48IS 21
	Matrox	26
	Maxpro	48IS 11
	MEU Cymru	48IS 3
	Microelectronics and Computer Technology	83
	Micro Firmware	181
1066	Micrografx	117
1027	Micromint	133
984	MicroNet Technology	192
1245	MicroProse Software	181
1074	Microsoft	26, 49, 52, 83, 113, 117, 127, 137, 173, 48IS 3, 48IS 5
	MicroStrategy	83, 91
99	Microtest	191
	miro Computer Products	26
	MIT	91
1319	ML Electro-Optics	48IS 23
982	MountainGate Data Systems	190
997	Mustang Software	196
	N	
	National Computer Security Association	179
	National Institute of Standards and Technology	179
	NCPengineering	48IS 11
1076	NeoMagic	52
1164	Nestor	83
1000	NetManage	197
1342	Network Connectors	48IS 23
996	Network Integrity	198
	Network Systems	179
1336	Network Utilities	48IS 26
1322	Nighthawk Electronics	48IS 22
1347	Nohau	48IS 27
	Nokia	48IS 3
1327	Nomis	48IS 26
	Northern Telecom	48IS 5
	Novell	26, 127, 48IS 3
	Number Nine Visual Technology	26
	Nu-Mega Technologies	26
	O	
	OAZ Communications	137
	Olivetti	48IS 3, 48IS 5
1313	Opti International	48IS 21
993	Optisys	192
1152	Optus Software	137
	Oracle	26, 48IS 5
	Oracle/IRA Software	91
	P	
	Packard Bell	52
1083	Panda Project	52
1026	Parallax	133
1339	Pathfinder	48IS 28
999	Pendock Mallorn	197
	PictureTel	69
	Pilot Software	91
	Planning Sciences	91
1242	PowerQuest	181
	Prism Solutions	97
1002	Progress Software	197
	Progressive Networks	26
	Q	
	Quest Standard Telematique	48IS 11
	R	
	Radius	26
	Raptor Systems	179
	Reduct Systems	91
1153	Resource Partners	137
1157	RightFax	137
	Rockwell	123
990	Rockwell Network Systems	192
1060	RSA Data Security	77
	S	
	Sagem USA	69
1318	Scensys	48IS 21
1080, 1237	Sceptre Technologies	52, 146
1337	Sentfactor	48IS 27
	Siemens	52
	Siemens Nixdorf	48IS 3
	Silicon Graphics	48IS 5
1326	SLAB	48IS 25
	Software AG	91
1346	Softwerk	48IS 28
977	Sony Component and Computer Products Group	191
	Spectron Microsystems	52
	SRILOG	48IS 17
	Standard Microsystems	26
1009, 1073	Stylus Innovation	117, 196
	Sun Microsystems	52, 173
1330	Sunbelt International	48IS 25
1332	SuperOffice	48IS 26
	Synaptel	48IS 11
1015	Syntegration	198
1341	SysKonnect	48IS 23
	T	
1321	Tadpole Technology	48IS 22
	Tandem Computers	97
	Target Technologies	69
983	Tektronix	191
	Telos	179
987	Ten X Technology	192
	TereNet	83
	Texas Instruments	52
	3Com Sonix	48IS 11
1071	3D/Eye	117
	3Dlabs	167
	TNO	48IS 17
1156	Traffic USA	137
1012	Trinzic	91, 197
980	Tri-Star Computer	190
	Trusted Information Systems	179
1324	Turnpike	48IS 25
	U	
	U.S. Robotics	137
	V	
	VCC	69
1244	V Communications	181
	Versit	52
	Viewpoint Systems	69
1072	Visio	117
1016	Visual Numeric	198
	Vivo Software	69
	W	
	Watcom	6
1240	Western Digital	181
1331	Widget Software	48IS 28
989	WinBook Computer	192
	X	
985	Xerox	190
	Xing Technology	26
	Y	
	YARC Systems	26
	Z	
1238, 1239	Zeos International	146
1338	Zincom	48IS 28
1028	Z-World	133
	Zydacron	69

IS pages appear only in the International edition. NA pages appear only in the North America edition.

BYTE (ISSN 0360-5280) is published monthly by The McGraw-Hill Companies, Inc. U.S. subscriber rate $29.95 per year. In Canada and Mexico, $34.95 per year. European surface mail subscriptions $60, airmail $85. Non-European subscriptions, $60 surface mail or $85 airmail. All foreign subscriptions are payable in U.S. funds that can be drawn on a U.S. bank. Single copies $3.50 in the U.S., $4.50 in Canada. Executive, Editorial, Circulation, and Advertising Offices: One Phoenix Mill Lane, Peterborough, NH 03458. Second-class postage paid at Peterborough, NH, and additional mailing offices. Postage paid at Winnipeg, Manitoba. Canada Post International Publications Mail Product Sales Agreement No. 246492. Registered for GST as The McGraw-Hill Companies, Inc., GST #123075673. Printed in the United States of America. **Postmaster**: Send address changes and fulfillment questions to BYTE Subscriptions, P.O. Box 552, Hightstown, NJ 08520.

BIX: Your Coach to the Internet!

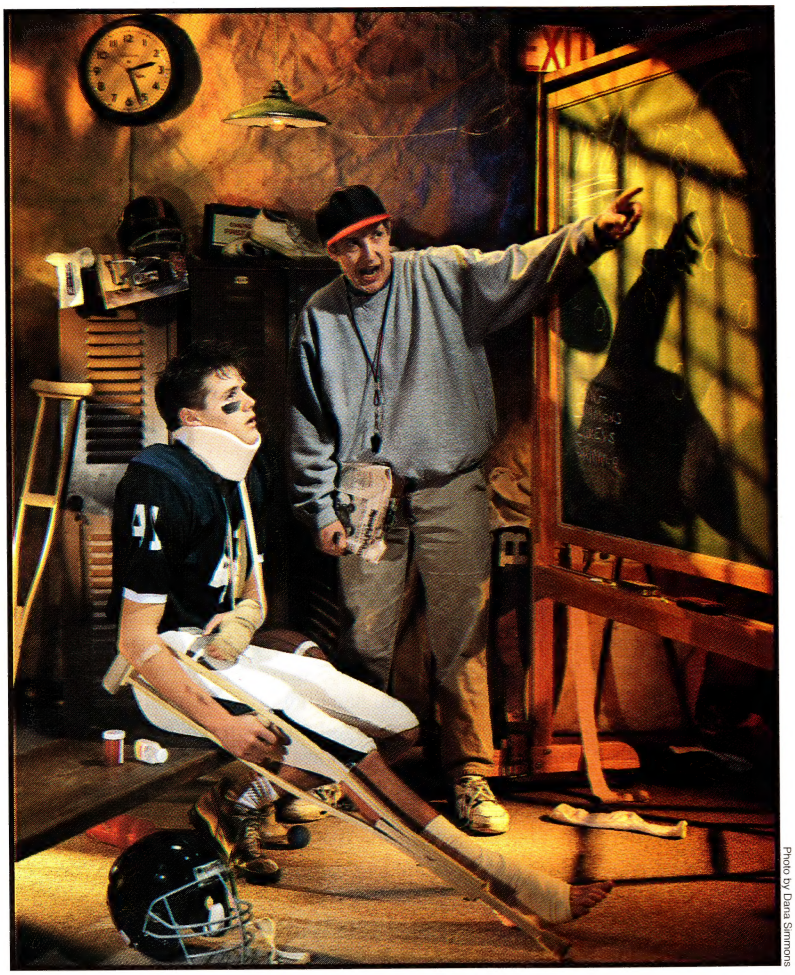


Photo by Dana Simmons

The Internet connects you with more than 10 million people , at universities, companies, and other online services. Now, get full access to the Internet free of charge when you subscribe to BIX! You'll also get expert assistance from BIX moderators who can help you find your way around the Internet.

These experts can guide you through the many services and features available, and help you find the information you're looking for. Anytime you need help, just join our special 'internet' conference and get fast answers to your questions.

As you become more familiar with the Internet, you'll be able to download files from all over the world using FTP, connect to other sites and services through telnet, read and reply to Usenet Newsgroups, access utilities like finger and whois, and much more! BIX and the Internet together provide the largest and most effective technical resource for computing professionals.

And with over 600 local access numbers in the U.S., plus telnet access via the Internet, BIX makes it easy to connect. Try BIX today through our special 5 for Free offer - and become part of the top technical team!

New Member
5 hours for Free
Introductory Offer

Give BIX a try with our new 5 for Free Offer! Join BIX today and get 5 hours of evening and weekend access for free! Take the rest of the calendar month to explore BIX, and then continue for our standard $13 monthly membership fee. Further details and complete rate information are provided during registration. Using any communications program, dial 1-800-695-4882. At the "logon" prompt enter bix. Then at the "name?" prompt enter bix.byte39. If you have any questions, call us at 1-800-695-4775 (voice). Or fax us at 617-491-6642. Send Internet mail to info@bix.com. Windows users can order BIXnav, our graphical interface for BIX, for easy point and click access. Details are available during registration.

BIX

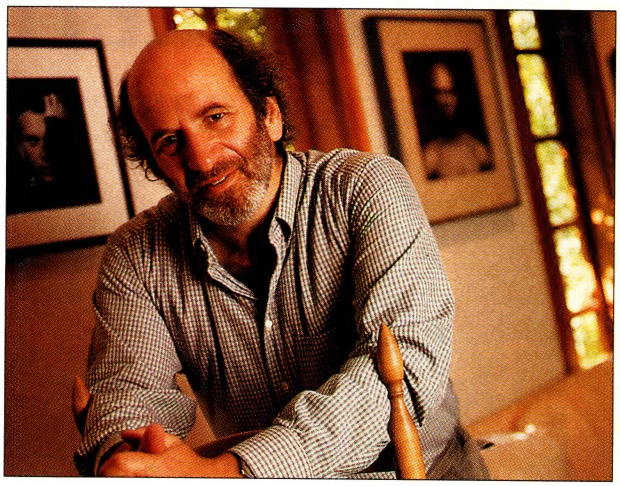
If you can hack it

Under the 5 for Free plan, daytime rates ($9/hr.) apply for access during prime time hours. The 5 for Free offer is valid for first-time members only.

Circle 450 on Inquiry Card.

Ambiguity Machines

Precision, hah! Computers are better at poetry than they are at math.



DAVID TOERGE © 1995

It should not have taken the Pentium math-bug debacle to remind us that computers do not always deliver absolute precision. On the contrary, for all their grounding in mathematical exactitude and their annoying literal-mindedness, computers are really ambiguity-generating machines.

Consider humble E-mail, perhaps the simplest form of computer-mediated communication. At first glance, the difference between a message written on paper and sent through the postal service versus its identically worded electronic counterpart seems insignificant: Both contain the same language, so their meaning is the same—or is it?

One is an artifact of the material world, with intimations of permanence. The other, a captive of cyberspace, can be eliminated in a keystroke. One is evocative—its paper quality, handwriting, and scent all convey nuances of meaning—while the other is framed within the bland uniformity of ASCII. Moreover, it is unlikely that the two messages would use precisely the same words. The tendency in E-mail is toward informality: *Gonna* and *gotta* replace *going to* and *must*. The shift in E-mail is toward oral speech patterns, a rejection of the precision of written discourse in favor of spontaneity.

In publishing, the distinction has starker ramifications. A conventionally printed book may be valued not just for the words inside it but as an object, whose worth is often dictated by such factors as whether it is a first edition, whether its author signed it, or whether a famous person owned it. In contrast, an electronically published book is an entirely different animal. For starters, the idea of copyright is undermined, since the digital book is infinitely reproducible. The notion of authorship is weakened, for the new medium encourages collaboration, often by anonymous contributors. Even the idea of the book itself is threatened, as publishers of electronic scholarly journals have already discovered.

Photography is also rendered fuzzy by digitalization. The malleability of digitized photographs has caused people to look on all photos with deepened skepticism. It is now virtually impossible to tell which images are digitally manipulated. Although photographic trickery has been around for almost as long as the camera, digital technology makes it much easier to doctor an image. Digital art has also broken down the distinction between an "original" and its copies, for all possess the same digital components.

In some digital pursuits, ambiguity is exactly the point. In Multiuser Dimensions, or MUDs, those adolescent computer playgrounds in which players take on imaginary identities while cavorting within a fictional universe, much of the excitement stems from the simple fact that few players know with certainty anything about one another. The player with whom I'm conversing may be a man who presents himself as a woman, a woman presenting herself as a man, or, for that matter, a cleverly designed "bot" that responds to comments in ways that produce the illusion of personhood.

Digital audio raises interesting questions. Composer John Oswald's Plunderphonics, for example, consists of works by musicians ranging from Beethoven to Michael Jackson that Oswald had digitally manipulated in startling and amusing ways. By creating "new" works out of familiar ones, Oswald demonstrated that musical authorship is a surprisingly complex issue, since all music borrows from all the sounds that surround us.

One reason for the rise of computer-generated ambiguity surely is the newness of digital technology. Just as in the early years of electrification and the telephone, we're still trying to figure out what we want computers to do for us, and in the meantime we're confused.

But something else is going on here as well. We like to think of computers as innately masterful at computation (thus, our ridicule for the Pentium when it returns inaccurate results). But we tend to forget that because some number strings are infinitely long, even the most sophisticated computers must settle for numerical approximation—which is to say, imprecision. And imprecision doesn't apply just to computation. While computers' breathtakingly broad impact stems from their capacity to render so much of reality in 0s and 1s, we forget that those combinations of 0s and 1s are all approximations or, put another way, metaphors. Of course, metaphors rightfully dwell in the province of poetry, where they don't mimic reality but use ambiguity to evoke it. ■

Jacques Leslie (jacques@well.com) writes frequently on the social impact of computers. He is the author of The Mark: A War Correspondent's Memoir of Vietnam and Cambodia *(Four Walls Eight Windows, 1995).*

Finish Out Your Rack with a Magnum Commander

- **Control up to 96 file servers with just 1 keyboard, monitor and mouse**
- **Supports all 100% IBM compatible PCs and PS/2 or serial mice; integral Sun and optional Macintosh support available**
- **3.5" unit is designed for 19, 23, and 24" rack applications**
- **Each unit controls up to 16 file servers; cascade up to 6 units**
- **Control all computers locally, remotely, or both**
- **AutoBoot™ feature boots all computers without user intervention**
- **Push-button and keyboard controlled scanning standard**
- **Rear peripheral access available**

COME SEE US AT
Networld+Interop in Atlanta, GA, Sept 27–29, Booth #5166

An Inc. 500 Company

MAGNUM COMMANDER™

Cybex Corporation
4912 Research Drive Huntsville AL 35805 USA
(205) 430-4000 (205) 430-4030 fax

CYBEX™

IBM, PC, and PS/2 are registered trademarks of International Business Machines Corporation. Macintosh is a registered trademark of Apple Computer, Inc. Sun is a trademark of Sun Microsystems. Cybex, Commander, and AutoBoot are trademarks of Cybex Corporation.

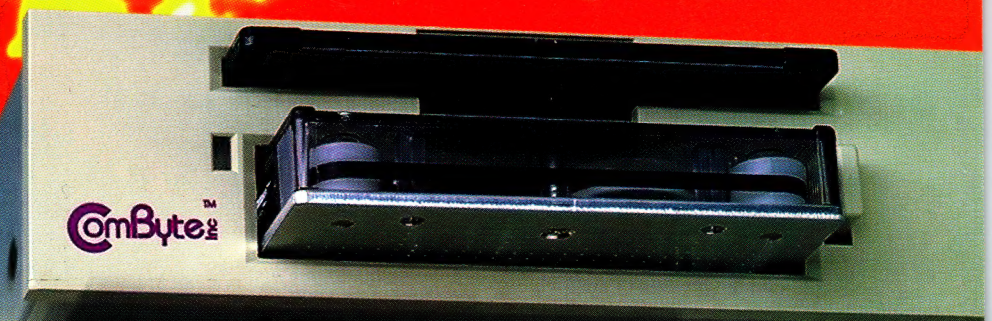
Dealer Program Available

Made in USA

Circle 506 on Inquiry Card (RESELLERS: 507).

When just a floppy won't cut it!

Doubleplay™ Series I



File sizes are growing ...how about your floppy?

NOW 800MB

Using Verbatim or Gigatek 1000' tape cartridges.

- Dual mode drive reads and writes both floppy and tape.
- Doublespeed floppy.
- Industry standard floppy and QIC80 tape formats .
- Copy or move files to tape in Windows File Manager.
- Tape librarian keeps track of files on all your tapes.
- 3 year warranty.

ComByte inc®

4424 Innovation Drive, Ft Collins, CO 80525 • 1-303-229-0660

Available through:

United Kingdom - CMS Peripherals - 0171 704 0202

Germany - CTT - 089 420 9000

Netherlands - ICP - 02940-30636

Circle 540 on Inquiry Card (RESELLERS: 541).